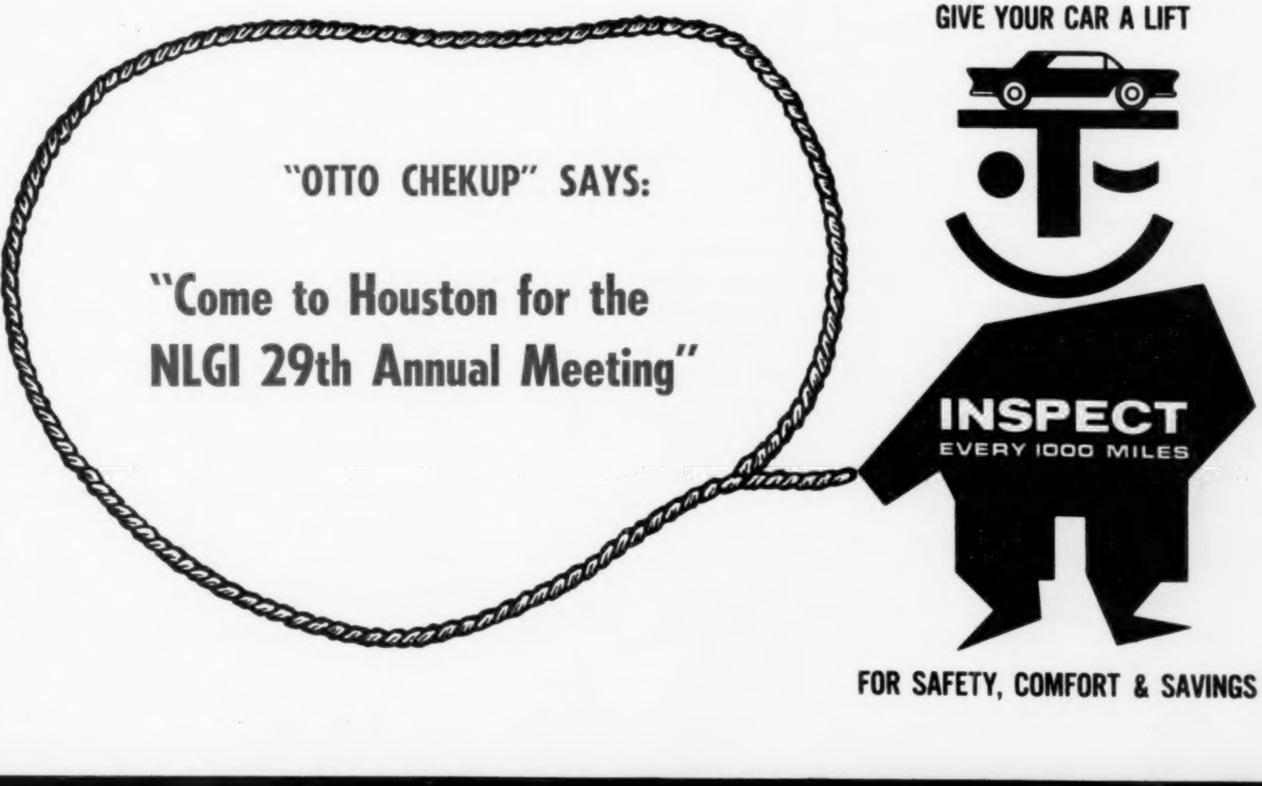
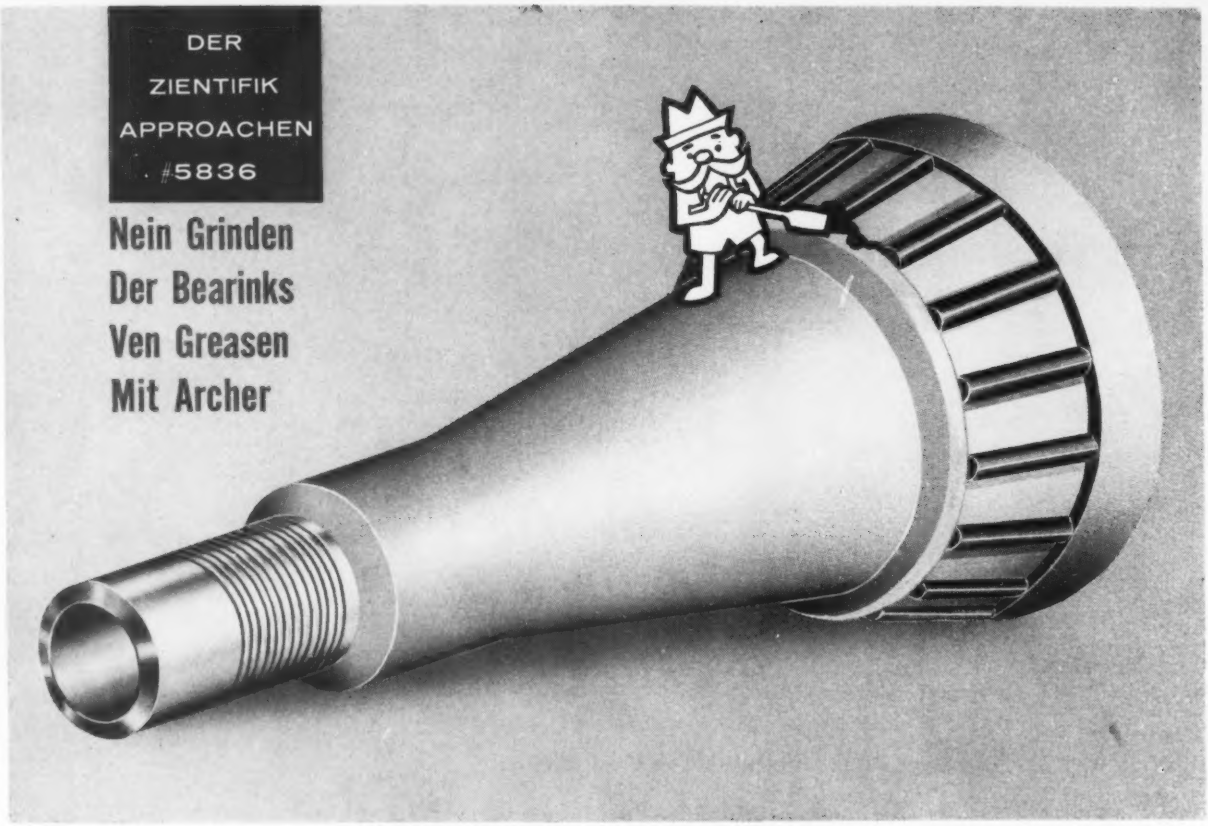
october, 1961

nlgi spokesman

journal of the national lubricating grease institute

29th annual meeting
national lubricating grease institute
october 29 – november 1, 1961
rice hotel, houston





Hydrofol Acid 51 ist Bearen der Wearen

Upstanden unter stressen! Greases made with Archer's grease grade Acid 51 have toughness that stands up under stress. They inherit it from the arachidic and behenic acids this hydrogenated marine oil acid carries. These long chain acids (C_{20} and C_{22}) also tend to keep grease from separating under prolonged punishment.

But das ist not alles! Hydrofol Acid 51 means versatility in any language. With arachidic and behenic acids, it combines fatty acids with chain lengths starting at C_{14}. The result is a base ideal for greases that must lubricate efficiently under a broad range of mechanical and environmental conditions . . . mit out wearink der bearinks. Extreme pressures. High temperatures. Contaminants. Shock loads. Shearing and squeezing actions. Especially recommended for automotive wheel bearings and industrial machinery bearings.

AXIOM: Ven Shooten for der Toppen, to Archer der Order Given.

Hydrofol Acid 51 is readily soluble in petroleum oils and most solvents. It resists oxidation and contains no polyunsaturated acids. Unt it's so economik! Its versatility lets you simplify your raw materials inventory, and thereby cut expenses.

Vant der zientifik scoopen? Den writen soonish to unter addressen. Technical data and research samples will be sent to you.

SPECIFICATIONS

Titer	51-53°C
Acid Value	197-202
Iodine Value	6 max.
Calculated Molecular Weight	277-284
Color 5¼" Lavibond	25Y/2.5R max.

Archer-Daniels-Midland
CHEMICAL GROUP
741 INVESTORS BUILDING
MINNEAPOLIS 2, MINNESOTA

nlgi spokesman

Volume XXV October, 1961 Number 7

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THE COVER

NLGI'S "little man" goes western as the Grease Institute moves to Texas for its 29th Annual Meeting. We hope to see you in the new "Oil Capital of the World" beginning October 29 and running through November 1. Things get started with an exciting "Mr. and Mrs. Early Bird Reception" (note the hosts on page 197), and all of the experts (shown beginning on page 198) take over then, bringing you the latest developments in the world of lubrication. There's plenty for the ladies to do during the meetings, so bring them along for the time of your life in Houston!

NLGI PRESIDENT'S PAGE

By F. R. HART, President

FDA Hazardous Substances Labeling Regulation

The new FDA Hazardous Substances Labeling Regulation could have a very profound effect on your present method of making, packaging and selling grease. For this reason, I am briefly outlining below the objectives of the new regulation, its possible effect on your business, and what NLGI is doing to relieve a potential industry hardship. I know you will want to study this regulation further so as to be better prepared to cope with it in the future.

Objectives

The new regulation is intended to control the sale and distribution of hazardous household products and to assure the consuming public that the labeling of hazardous products will be uniform and adequate with respect to individual materials. One part of the regulation became effective February 1, 1961. This part includes highly toxic, highly flammable and flammable materials. Another part of the regulation, dealing with toxic substances, irritants, extremely flammable and flammable substances, strong sensitizers, will become effective February 1, 1962. The complete regulation is intended to protect the welfare and health of the consumer using products which come into the household.

Effect On Petroleum Industry

Any package used for petroleum products that finds its way into the household must be suitably labeled if it contains a hazardous material. This means that the package contents must be tested for toxicity by methods prescribed in the regulation. The cost of determining the toxicity of any lubricating grease could be very high and may result in product reformulation or even cancellation. The use of poison labels, particularly those illustrating skull and crossbones, or other warning identification, may discourage product purchase and use. Oil companies who have nontoxic products would temporarily have a market advantage over those who do not have such products. An added marketing expense may be incurred by use of special package and carton labels, thus reducing product realization.

What NLGI Is Doing

Last July 13, your General Manager appeared before the FDA Commissioner to ask for relief from the regulation as presently worded. He supported the formal statements the industry filed with FDA on this regulation and stated in part:

1. Lubricating greases are not considered to be home use products.
2. If warning labels are needed for packages filled with grease, they should be affixed to the small packages only.
3. Warning labels will not stop people from eating lubricating grease if they do not read or understand the wording in the label.
4. Any label adopted should be of a type that will not conflict with brand names, product use instruction or oil company signature.
5. He asked that the present regulation be modified to remove an industry hardship; also that a revised regulation, containing these proposals, be submitted for public hearing and that no positive action be taken prior to February 1, 1961.

The FDA Commissioner agreed to postpone penalty provisions until February 1, 1962 with respect to all hazardous substances except those which are highly toxic, extremely flammable and flammable. The Federal Caustic Poison Act remains in full force and effect during the period of this extension for any article affected thereby.

An up-to-the-minute report will be made to the membership by an expert on the subject, at the Annual Meeting in Houston.

Conclusion

On August 12, the FDA granted relief to the extent products intended for industrial use only, are not subject to the regulation if and when they are taken into the home by a serviceman or misappropriated by an industrial worker for his own use. Under the law, the phrase, "for industrial use only" may be used on hazardous products, thereby avoiding the use of more cautionary labeling. However, the marketing of a product so labeled must be restricted to industrial accounts only.

Relief was also granted to the extent that the full warning statement as set forth in the regulation need not appear on the main package label panel; also, greater flexibility is permitted in the selection of type size. Company literature has been defined to include only that literature containing directions for product use. No change was made in the limits used for defining toxicity. ■

Molysulfide® News Digest

CLIMAX MOLYBDENUM COMPANY, a division of American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N.Y.

EDITORIAL PAGES OF LEADING TRADE MAGAZINES FEATURE MoS_2 INFORMATION

Higher temperatures, lower temperatures, greater pressures, longer lubrication life, all have combined to focus more attention on the uncommon lubricating values of molybdenum disulphide.

That's why editors are devoting more and more space to descriptions of what MoS_2 can and cannot do.

One article tells how MoS_2 prevents harmful friction in brake linings. Another discusses its use as a compressor lube substitute. Still another reports on tests of epoxy-resin compositions containing high concentrations of MoS_2 for industrial use on bearings, seals and friction strips.

Press fittings, wire drawing, cutting tools, ball joints—there are MoS_2 stories about these uses, too.

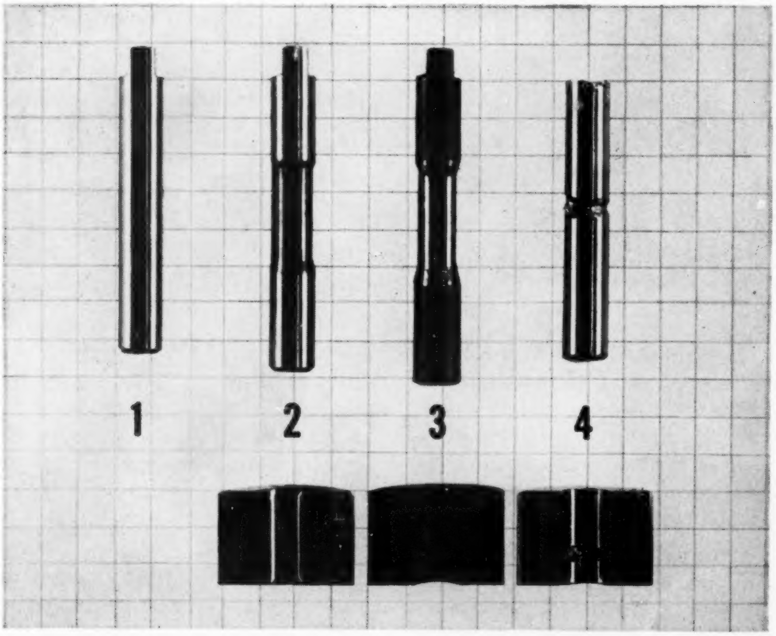
MoS_2 as a solid-film dry lubricant has been the subject of several articles. One details high-temperature properties; another describes a new bearing design that can increase bearing life as much as 450%.

Write us for a complete bibliography of published material on molybdenum disulphide.

P.S. Climax publishes a newsletter that describes even more uses. Let us know if you'd like your name on the mailing list.

When writing, refer to CL-116

Proof of MoS_2's High-Pressure Properties



Photograph above shows mild steel test pins. No. 1: Unused pin, No. 2 (lubricated with mineral oil and Molysulfide) and No. 3 (with Molysulfide bonded coating) were subjected to rotating pressures between bearing halves. Both were elongated and extruded without galling, seizing, or weight loss. No. 4 shows typical failure with conventional lubricant. Note that the key sheared off and pin and block were galled and seized.

When writing, refer to CL-118

Use of MoS_2 Paste-Type Concentrates Shows Growth

These lubricants, containing higher-than-usual amounts of Molysulfide, first proved their value in press fit assemblies of pump gears and shafts. By completely preventing galling and seizing, and eliminating bent shafts, MoS_2 saved one company $1,821 annually on that operation alone.

The use of MoS_2 then spread to pins, engine block studs, and threaded connections, where not only ease of assembly but ease of disassembly is important.

Today, Molysulfide paste-type concentrates have proved to be the most versatile of MoS_2 lubricants. They are particularly effective wherever high load conditions exist—on splines, universal joints, ball joints, sleeve bearings, and machine ways and as wear-in and drawing lubricants.

When writing, refer to CL-117

News About NLGI

NLGI's Little Man Named "Otto Chekup"

"Otto Chekup" is the new name for NLGI's little man, the registered cartoon-type character introduced early this year by the Institute, to tell the car care story at a glance.

A naming contest made the decision difficult, instead of easy, as originally envisioned . . . over 100 descriptive names were submitted by men of the lubrication industry, and each had merit. The judges' final decision was even more difficult when it is realized there were eleven entries employing a varia-

tion of the name "Otto" alone. The winning name was one of five offered by W. W. Whyte of Texaco Canada, assistant manager of advertising and sales promotion, in Montreal. A check for $50 was awarded Mr. Whyte following acceptance of the name at the recent Institute Board of Directors meeting in New York City.

"Otto Chekup," both name and figure, will continue to strive for motorist attention, to get the automobile up on the lift, and for lubrication at regular intervals.

American Grease Stick, H. W. Stratford Co. Join NLGI

American Grease Stick company of Muskegon, Michigan has joined NLGI as an Active member firm. Leo S. Rosen, sales manager, will serve as Company and Technical representative to the Institute.

H. W. Stratford Co., Inc. of Kansas City has joined NLGI as an Associate member firm, as a supplier of equipment for manufacturing lubricating greases. H. W. Stratford will serve as Company and Technical representative.

Coates Resigns From Board of Directors

The resignation from the NLGI Board of Directors of John J. Coates, Humble Oil and Refining company, Everett, Mass., was announced by F. R. Hart, NLGI president. A change in responsibilities with his firm brought about Coates' leaving the Institute.

J. J. Coates

Coates was elected to the Board in 1959 and has served on the production survey, chassis lubrication, publicity and program committees. This year, he was chairman of the membership committee and a member of the executive committee.

Replacing Coates as NLGI Company representative from Humble will be C. E. Smith, Jr., product coordinator, industrial and specialty sales, of the Humble marketing department in Houston.

Name Representatives

Cities Service Oil company of New York has named Harold F. Jones, manager of lubricating oil sales, to serve as NLGI Company representative.

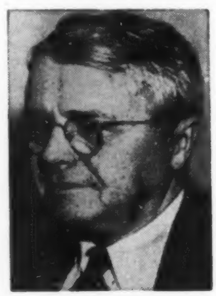
Riley Brothers of Burlington, Iowa has named Philip Zentgraf as Technical representative to NLGI.

Revised NLGI GLOSSARY Now Available

A revised NLGI Glossary of terms and definitions relating to the lubricating grease industry is now available from the national office of the Institute . . . price per copy, fifteen cents. The second edition has fourteen newly-approved terms and, with previously authorized definitions, now offers a total of more than 60 terms and definitions.

F. C. Kerns

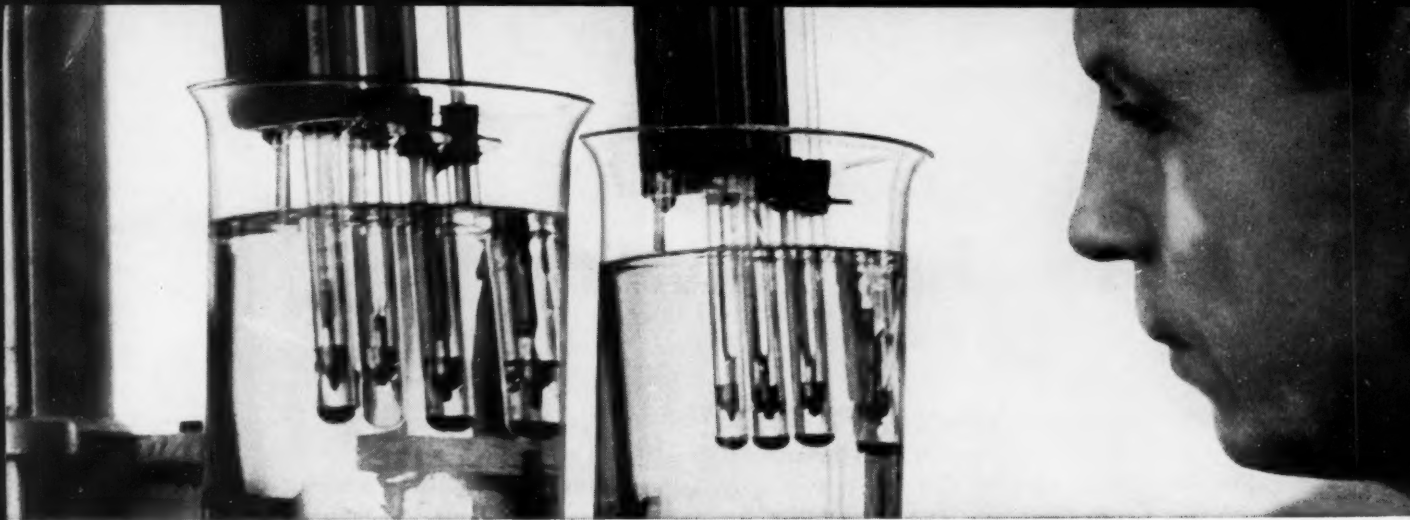
Mr. F. C. Kerns, a longtime member of the NLGI Board of Directors, a past president (1941), and an Honorary Member of the Institute, died August 25 after an illness of two months. Since his retirement



F. C. Kerns

from Texaco, he had made his home at Gillette, New Jersey.

One of the men responsible for founding NLGI, Mr. Kerns served as a Board member from 1934 until 1950. In 1955 he was made an Honorary Member of the NLGI.



Dropping point test shows how greases react to heat. Beaker fluid has been heated to 390°F. All greases tested except Darina (second tube from left) have passed from solid to liquid state.

BULLETIN:

Shell reveals the remarkable new component in Darina Grease that helps it save up to 35% on grease and labor costs

Darina® Grease is made with Microgel*, the new thickening agent developed by Shell Research.

Darina lubricates effectively at temperatures 100° hotter than most conventional soap base greases can withstand.

Read how this new multi-purpose industrial grease can help solve your lubricating problems and even save you up to 35% on grease and labor costs.

There is no soap in Darina Grease. No soap to melt away—wash away—or dissolve away.

Instead of soap, Darina uses Microgel—a grease component developed by Shell Research.

What Microgel does

Because of Microgel, Darina has no melting point. It won't run out of gears or bearings.

Compared with most conventional soap-base greases, Darina provides significantly greater protection under adverse service conditions.

Mix water into Darina and the grease does not soften. It shrugs off water—won't emulsify.

Resists heat

Darina will withstand operating temperatures 100° hotter than most conventional multi-purpose greases. It cuts leakage and reduces the need for special high-temperature greases.

Also, Darina resists slumping, thus forming a more effective seal against foreign matter.

Saves money

Shell Darina can reduce maintenance expenses while it protects your machinery. Savings of up to 35% on grease and labor are quite possible.

In some cases lubrication intervals have been extended to double what they were before. Less grease is consumed and less time consumed applying it.

For details, see your Shell Representative. Or write: Shell Oil Company, 50 West 50th Street, New York 20, New York.

*Registered Trademark

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are helping to provide better products for industry

Future Meetings

OCTOBER, 1961

17-19 ASME-ASLE Lubrication Conference, Hotel Morrison, Chicago.

18-20 Packaging Institute, 23rd Annual National Packaging Forum, Biltmore Hotel, New York City.

OCT. 29 - NOV. 1, 1961 NLGI Annual Meeting, Rice Hotel, Houston, Tex.

NOVEMBER, 1961

6-7 Petroleum Packaging Committee, Packaging Institute, Fort Shelby Hotel, Detroit, Mich.

9-10 SAE National Fuels and Lubricants Meeting, Shamrock-Hilton Hotel, Houston, Texas.

13-15 American Petroleum Institute Annual Meeting, Conrad Hilton Hotel, Chicago.

26-Dec. 1 ASME Winter Annual Meeting, Statler Hilton Hotel, New York.

JANUARY, 1962

8-12 Society of Automotive Engineers, Annual Meeting, Cobo Hall, Detroit, Mich.

21-26 ASTM Committee D-2 meeting, Chase-Park Plaza Hotels, St. Louis, Mo.

FEBRUARY, 1962

21 NLGI Board of Directors meeting, Sheraton-Cadillac Hotel, Detroit, Mich.

APRIL, 1962

2-3 National Petroleum Refiners Association, Spring Meeting, Granada Hotel, San Antonio.

MAY, 1962

22-25 API Division of Marketing, Midyear Meeting, Queen Elizabeth Hotel, Montreal, Canada.

OCTOBER, 1962

16-18 ASME-ASLE Lubrication Conference, Pittsburgh Hilton Hotel, Pittsburgh, Pa.

21-24 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago.

NOVEMBER, 1962

25-30 ASME Winter Annual Meeting, Statler Hilton Hotel, New York City.

YOU CAN STOP LOOKING!

CONTINENTAL HAS THE STEEL PAIL YOU NEED

Whatever your product, chances are Continental has the right steel container for you. And while steel containers may *look* alike, only Continental has the time-tested experience that leads to perfection in all aspects of metal packaging.

To you, this experience means consistently superior containers...exciting lithography...a dependable source of supply...research facilities second to none...famous Continental service.

For the pail you need, call Continental today.

CONTINENTAL CAN COMPANY

Eastern Division: 633 Third Ave., New York 17
Central Division: 135 S. LaSalle St., Chicago 3
Southern Division: 905 Florida Ave., Tampa 2
Pacific Division: Russ Bldg., San Francisco 4
Canadian Division: 790 Bay Street, Toronto 1
Overseas Division: 633 Third Ave., NewYork 17

WELCOME TO HOUSTON!

You Are Invited to a

Mr. and Mrs. Early Bird Reception

The "Mr and Mrs. Early Bird Reception" is now a regular part of the Annual Meeting program . . . it's a wonderful way to make new friends and greet old acquaintances before the sessions begin. Starting Sunday evening at six in the Grand Ballroom of the Rice Hotel, "Early Birds" will have the following companies as hosts:

Firm	*Host*
American Flange & Manufacturing	J. R. Ringgold
American Potash & Chemical Corp.	W. F. O'Brien
Archer-Daniels-Midland Company	J. H. Kane
Baker Castor Oil Company	J. W. Hayes
Baroid Chemicals, Inc.	C. M. Finlayson
Bennett Industries, Inc.	R. R. Ernst
Central Can Company	H. Frazin
Climax Molybdenum Company	K. B. Wood, Jr.
Continental Can Company	W. J. Flint
Darling & Company	L. Strauf
Emery Industries, Inc.	W. N. Fieglein
Enjay Chemical Company	S. L. Wythe
Foote Mineral Company	W. M. Raynor
Geuder, Paeschke & Frey Co.	N. Savee
HumKo Products (Chemical Division)	G. W. Collins
Inland Steel Container Co.	J. W. Hayes
Jones & Laughlin Steel Corp.	J. E. Morris
Lincoln Engineering Company	R. E. Crean
Lithium Corporation	M. M. Moore
Lubrizol Corporation	J. B. Irwin
Monsanto Chemical Company	G. R. Buchanan
R. C. Can Company	H. H. Ellerbrock
Rheem Manufacturing Company	G. G. Tucker
Rieke Metal Products Corp.	R. F. Ouer
Sefton Fibre Can Company	W. V. Swofford
Southline Metal Products Co.	W. F. Wackman
Steel Package Div., National Lead	W. T. Trask
United States Steel Corp. (Steel Products Division)	F. T. Corbin
Wallace & Tiernan, Inc. (Harchem Division)	H. M. Abbott

1961 Annual Meeting Papers and Authors

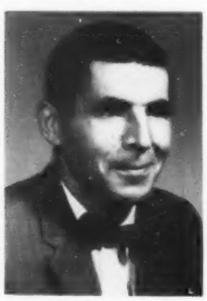
Rice Hotel, Houston, Tex. October 29—November 1, 1961

Korp

Keynote Address

Evans

Pardo



Nicholaichuk

Fluid Gear Lubricants—Their Future

By H. J. KORP, Southwest Research Institute

H. J. KORP received a BS degree in chemical engineering from the University of Pittsburgh, where he also did graduate work. He is also a graduate lawyer, having received his LLB from St. Mary's university in 1957. From 1941 to 1943, Mr. Korp was an assistant fellow at the Mellon Institute where he did research on synthetic rubber pilot plant operation. In 1943, he joined the explosives research laboratories of Carnegie Tech as a design engineer group leader. He next became associated with Socony Vacuum research and development laboratories and was a senior technologist with that organization until he joined Southwest Research Institute in 1953. He was chairman of the engines, fuels and lubricants department before being appointed to his present position of technical vice-president in 1959. Author of numerous articles in the field of fuels and lubricants research, Mr. Korp is a member of the ACS, AIChE, SAE, ASTM Committee D-2, three CRC technical committees, API and RESA, among other groups.

The Development Of Commercial Lubricating Greases Using Rapeseed Oil

By I. S. EVANS, Saskatchewan Research Council, J. P. PARDO, General Lubricants Mfg. Co., Div., Sta-Vis Oil Co., M. P. NICHOLAICHUK, Federated Co-Operatives Ltd.

I. S. EVANS graduated in mechanical engineering from the University of Wales in 1939 and took post graduate studies at the Military College of Science. He served in the Royal Electrical and Mechanical Engineers in Europe and Africa, attaining the rank of major. Mr. Evans was associated with the heavy mechanical and heavy chemical industries, prior to joining the Saskatchewan Research Council seven years

ago. He is presently head of the division of information services, Saskatchewan Research Council, engaged mainly in increasing provincial industrial potential. Mr. Evans is a member of the Engineering Institute of Canada, the Association of Professional Engineers (Saskatchewan), Institute of Information Scientists, Operations Research Society and Institute of Management Science.

J. P. Pardo received a BS degree in chemistry from St. Thomas college, St. Paul, Minn., and took advanced engineering courses at St. Mary's college, Winona, Minn., while serving with the United States Navy. As a Navy lieutenant, he attended chemical warfare school at Edgewood Arsenal in Maryland and later served in campaigns in the South Pacific and Atlantic. Mr. Pardo has been associated with Sta-Vis Oil Co. for 13 years and has served as general manager of General Lubricants Mfg. Co. since the formation of this company division in 1952. He has served as a vice-chairman of ASLE and is also a member of SAE.

M. P. Nicholaichuk received a degree in agricultural engineering from the University of Saskatchewan. Since graduation, he has been employed as a fuels and lubricants engineer by Federated Co-operatives Ltd. Mr. Nicholaichuk is a member of the Engineering Institute of Canada and the Canadian Society of Agricultural Engineering.

Abstract

Rapeseed is becoming an increasingly important crop on the Canadian Prairies. The paper discusses:

I. The importance of the rapeseed crop to Saskatchewan.

II. The development of multi-purpose lubricating greases using hydrogenated rapeseed oil by the Saskatchewan Research Council.

III. The problems of manufacture and their solution by the Sta-Vis Oil Co.

IV. User and more than one year of commercial experience of this lubricant by Federated Co-operatives Ltd.

Youse

Characteristics and Selection of Graphite As a Lubricant

By E. L. YOUSE, Joseph Dixon Crucible Co.

E. L. Youse received a BS degree in chemical engineering from Lafayette college, Easton, Pa., in 1943. After several years with Hercules Powder Co., he entered the field of pigment dispersion and colloid chemistry. Presently chief project engineer in charge of colloidal graphite products for the Joseph Dixon Crucible Co., Mr. Youse has for the past 16 years pursued the field of fine particle colloidal dispersions with concentrated effort in the category of solid lubricants both in fluid dispersion and in dry film coatings. He is the holder of several patents in the field of pigment dispersions and dry film lubricating coatings. Mr. Youse is Dixon's Technical representative to NLGI and is also active in ASLE, having served as treasurer of the New York section, as a member of the educational course committee and as membership chairman.

Abstract

Graphitic carbon content of graphites for lubrication is a factor of importance rather than merely total carbon purity. The graphitic structure of graphite can be destroyed by reducing the particle size too small. Control of particle size is important. Colloidal graphite additives to oils and greases are not dependent for their performance on temperature and reaction with friction surfaces as are chemical extreme pressure additives.

In the preparation of specialty graphited oils or greases, the environment and effect of other additives and the carrier used must be considered.

In order to define what constitutes a good graphite lubricant, the conditions of use must be explicitly defined. The selection of the best graphite lubricant is dictated by the condition of the specific job it is to perform.

Panzer

Nature of Acetate Complexes In Greases

By J. PANZER, Esso Research & Engineering Co.

J. Panzer graduated with a BA degree from New York university and received his PhD from Cornell university in 1956. Since that time, he has been performing research on greases in the industrial lubricants and greases section of Esso Research & Engineering Co. He is a member of the American Chemical Society.

Abstract

The literature indicates that greases made with soaps and salts of low molecular weight acids, particularly acetic acid, are chemical complexes in which the salt and soap are chemically combined. A study of calcium and barium complex soap-acetate greases has shown that the properties of these greases can be explained by the presence of mixtures in which the acetate and soap do *not* form chemical compounds. Much of the evidence suggests, however, that strong adsorption interactions between the soap and acetate develop during grease preparation.

Blake

Waghorn

Pilot Scale Manufacture Of Lubricating Grease

By E. J. BLAKE, British Petroleum Co. Ltd.
Presented by P. S. WAGHORN, BP (North America) Ltd.

E. J. Blake graduated from Glasgow university with a BSc degree in 1944. He joined the Research Centre of the British Petroleum Co. the same year, and has since worked on process research with particular emphasis on pilot scale programs associated with grease, bitumen, lubricating oil and petroleum chemical products. In 1955 Mr. Blake spent six months at the BP Refinery, Kwinana, Western Australia, where he assisted in the commissioning of treatment units and a continuous bitumen blowing plant.

P. S. Waghorn graduated from the University of London with a BSc degree in chemistry in 1954. During his two years of service as a radar instructor with the Royal Air Force, he developed an interest in electronics. He joined the Research Centre of the British Petroleum Co. in 1957 and worked on lubricant development in the products research section. In 1960 he began a tour of duty as a technical representative in BP's New York office.

Abstract

In order to acquire first hand knowledge of grease production techniques, a comprehensive pilot plant for the manufacture of greases has been installed and commissioned at Sunbury Research Centre. This paper describes the pilot plant and summarizes the information which is available to BP at the present time on the quality correlation between greases produced in the Sunbury 5 and 40 gallon scale equipment and those produced in commercial equipment.

The quality correlation as assessed by appearance, texture, inspection data and rig test data on a series of lithium, soda, lime and aluminium base greases has been shown to be good.

Dooley

The Federal Hazardous Substances Labeling Act

By A. E. DOOLEY, Texaco Inc.

A. E. Dooley was graduated from Bethany college in West Virginia. He served as assistant director of the Pennsylvania State Bureau of Industrial Hygiene. From 1942 to 1945, he was a major in the Sanitary Corps, U. S. Army, attached to the Army industrial hygiene laboratory. He has been an industrial hygienist for Texaco Inc. since 1947. He is a member of the American Industrial Hygiene Assn., the American Public Health Assn., and the API medical advisory committee. Mr. Dooley is also chairman of the API interdivisional committee on labeling.

Abstract

In a repeat performance, this expert advises what effect the Federal Hazardous Substances Labeling Act will have on the lubricating grease industry. The author has coordinated intra-industry efforts to prevent hardship and over-enforcement, caused by possible misinterpretation.

Hemmingway

Creativity Is Where You Find It

By H. L. HEMMINGWAY, Pure Oil Co.

H. L. HEMMINGWAY received his Master's Degree from the University of Wisconsin in 1932 and, after a short period as a high school science teacher, joined the Ashland Refining Co. in 1933. In 1935 he became associated with Kendall Refining Co. Since 1944 he has been with Pure Oil Co. where, in 1957, he was appointed director of research at the company's research center in Crystal Lake, Ill. Mr. Hemmingway was a member of the NLGI Technical Committee for several years and headed the subcommittee which originally developed the NLGI "Recommended Practices for Lubricating Automotive Front Wheel Bearings." He served as president of the Institute in 1955 and was a member of the board of directors 1943-1944 and 1948-1958.

Abstract

The author draws on more than 25 years of close observation of top-flight research people and salesmen to describe certain remarkable similarities between these two professions. Although the individuals involved are generally quite different in temperament, training and humor, they are alike in being individualistic, working at their jobs more than just "working hours," in their need for recognition, in working at jobs which require alert minds, in having similar problems with promotions, and in their tendency to gripe about how things are being run.

Boner

A Three-Decade Revolution

By C. J. BONER, Battenfeld Grease & Oil Corp., Inc.

C. J. BONER, a graduate of the University of Missouri, is chief research chemist for Battenfeld Grease & Oil Corp., Inc. Active in industry affairs, Mr. Boner is a member of ASTM, past chairman of the Kansas City section of ACS and past vice-chairman of the Kansas City chapter of ASLE. He received the NLGI Distinguished Service Award in 1955. At the present time, he is chairman of the technical subcommittee on the procurement of technical papers for publication in the NLGI SPOKESMAN. He is the author of the well-known book, "Manufacture and Application of Lubricating Greases," and also writes the literature and patent abstracts column which appears in the SPOKESMAN each month.

Abstract

Based on the definition of revolution: "A total or radical Change," some of the major changes in raw materials, processing, evaluation, distribution and application of lubricating greases, as they have taken place over the past thirty or forty years, are cited. The general thought is that consideration of such changes may suggest answers to future plans of our industry.

Price

Market Research: A Key to Profits In Farm Lubricants

By R. E. PRICE, Consumers Cooperative Assn.

R. E. PRICE received BS and MS degrees in agricultural economics from the University of Missouri. While studying at the university, he conducted research for the Missouri Farmers Assn. In 1956 he became a Research Associate at Iowa State university where he conducted a research program investigating costs of shipping grain by truck and pursued further studies in economics. He joined the economic research division of Consumers Cooperative Assn. in 1957. Since that time he has been actively engaged in a wide variety of research activity ranging from economic forecasting to plant location studies and marketing research covering the feed, fertilizer, farm supplies

and petroleum industries. He is a member of the American Farm Economic Assn. and the American Marketing Assn., currently serving as vice-president of the latter.

Abstract

The author discusses the use of market research and points out the need for effective market research in farm lubricants. In order to illustrate the profit opportunities, research is classified into three broad categories and examples emphasize research topics with high profit potentials. Corporate organization for the profitable use of research is discussed and attention is also given to ways in which relatively small firms can apply techniques of market research to advantage.

New Aspects of Grease Milling And Milling Equipment

By L. E. PUTNAM, Chemicolloid Laboratories, Inc.

Abstract

In close association with the National Lubricating Grease Institute over the past eleven years, a representative manufacturer of grease milling equipment presents observations and remarks pertaining to the strides made since the concept of grease milling was adopted.

Of general interest outside of the lubricating grease industry new concepts for process development are outlined. Advances in modern technology, formulation and manufacturing procedures will require of the equipment producers the best possible tools for use by the process industries.

With the advent of grease milling, the equipment manufacturers were confronted with a new process and new problems. Significant design changes and improvements in grease milling equipment over the past eleven years are summarized as pertaining to the closed continuous type of grease milling equipment.

Graham

Operating Techniques In Soap Making

By W. A. GRAHAM, Stratford Engineering Corp.

W. A. Graham received a BS degree in chemical engineering from the University of Kansas in 1948 and an MS degree in chemical engineering from the same university the following year. In 1949 he joined the Douglas Chemical Co., Kansas City, Mo. He has been associated with Stratford Engineering Corp., Kansas City, since 1958. He is engaged primarily in process studies and development, sales and sales development.

Abstract

Techniques followed by different grease plant operators using the Contactor for production of various soapstocks, are described. Some comparisons of other types of processing are shown. Data are presented showing the differences in processing based on the soap contents of finished greases, the quality of the finished greases, and the time required for production.

Nofsinger

Walas

Modern Techniques in Grease Manufacture

By C. W. NOFSINGER, S. M. WALAS, C. W. Nofsinger Co.

C. W. Nofsinger graduated from the University of Illinois with a BS degree in mechanical engineering. After several years with Sinclair Refining Co., he joined the M. W. Kellogg Co. where he developed the process and estimating department. Following a year as chief of the refinery division of the Petroleum Administration for War in 1945, he became consultant to several refiners and engineering firms. In 1950 he founded and became president of the engineering firm which bears his name. He is also vice-chairman of the board of directors of Western Petrochemical Corp.

S. M. Walas received a PhD degree in chemical engineering from the University of Michigan in 1941. He then worked for Armour Research Foundation, General Electric plastics division and Stone & Webster. In 1948 he became a professor at the University of Kansas and in 1951, he joined the C. W. Nofsinger Co.

where he became involved in the process design of the first large grease plant built by that company. Dr. Walas still divides his time between these two positions. He is the author of several papers in technical journals and of a book on chemical reactor design.

Abstract

New ingredients, new equipment and new processing methods have been developed for the grease industry in recent years. These factors have resulted in improvements in quality, economies of manufacture and broadening of the range of conditions over which specific lubricants can be used. All processing stages have achieved advances recently: soap manufacture, blending with oil and additives, milling, air and moisture removal, and packaging. Continuous processing has been applied in a few instances where justified by large production rates. However, most attention has been devoted to speeding up methods of semicontinuous processing, which will probably continue to be the type of operation used in the grease industry for some years to come. Significant improvements in quality are achieved by proper milling and air and water removal, and consequently equipment for achieving these improvements has found increasing acceptance.

Barrett

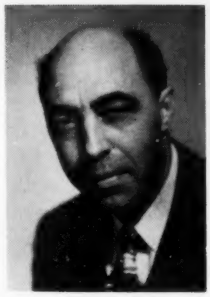
Packaging Machinery for The New Plant

By G. J. BARRETT, JR., Barrett Manufacturing Co.

G. J. Barrett, Jr., received his training in mechanical engineering at the University of Houston. During the war, he served in the U. S. Maritime Service, attending the U.S.M. officers school in New London, Conn. In 1946, he and his brother formed Barrett Manufacturing Co., which has since served the industry with grease packaging equipment.

Abstract

Some aspects applied in the consideration of existing equipment and the development of new designs will be included in the discussion of packaging machinery.



Pope

Lubrication and Design of Sleeve Bearings

By C. L. POPE, Eastman Kodak Co.

C. L. Pope graduated from Cornell university in 1926. He served his apprenticeship with Wright Aeronautical and was a master mechanic for Neidich Cel-Lus-Tra Co. He next worked in the purchasing department of General Chemical Co. In 1930 he joined Eastman Kodak Co., where he is section head for lubricants, bearing seals and mechanical drives, Kodak Park engineering consultant staff. A past president and member of the presidential council of ASLE, Mr. Pope received the Hunt Memorial medal presented by ASLE for contribution to the advancement of the science of lubrication. Elected a fellow of ASME in 1958, he is also a member of AGMA, ASTM and the Rochester Engineering Society. He is the author of several books in the field.

Paden

An Approach for Research in Grease Lubricated Cast Bronze Bearings

By C. N. PADEN, JR., Cast Bronze Bearing Institute

C. N. Paden, Jr., graduated from Georgia Institute of Technology in 1951. During World War II, he served two years in the U. S. Navy. For the past ten years, Mr. Paden has been sales manager and design engineer for Moccasin Bushing Co., Chattanooga, Tenn. He is also a director and secretary of the Moccasin Bushing Co., Chattanooga Aluminum Foundry Inc. and the Mountain City Metal Co. Mr. Paden helped to organize and create the Cast Bronze Bearing Institute, of which he is currently president.

Abstract

This paper deals with three years' work in developing bearing design data by the Cast Bronze Bearing Institute. It is a résumé of their previous, current research and their plans for future research.

The paper gives brief descriptions of their hydrodynamic and hydrostatic bearing research, primarily dealing with those aspects of this research pertaining to grease lubrication. An outline of their current research on thrust bearings is explained.

The bulk of the paper details plans for research specifically on grease lubricated cast bronze bearings. It gives limitations and expectations of the proposed work and plans for continuing work in this field.

Brunstrum

Borg

Sisko

Master Curves For Grease Flow

By L. C. BRUNSTRUM, A. C. BORG, A. W. SISKO, American Oil Co.

L. C. BRUNSTRUM has been a member of the research department of the American Oil Co. since he received a BS degree in chemical engineering from Armour Institute of Technology in 1929. He is now senior research associate in the research and development department. Active in ASTM, he is a member of ACS, the Society of Rheology and ASLE. A frequent contributor to the SPOKESMAN, Mr. Brunstrum is serving his second term as chairman of the NLGI Technical Committee. In 1958, he was the seventh man to be honored by the "Award of Achievement," after five years as Technical Committee vice-chairman and numerous contributions to the industry.

A. C. BORG has been associated with the American Oil Co. for more than twenty years. He received his BS in chemical engineering from Illinois Institute of Technology in 1951. For the past ten years, he has been in the field of lubricating greases. Holder of several patents and author of several papers, Mr. Borg is a member of AIChE and ASLE and has also been quite active in NLGI and CRC activities. His current assignment is as supervisor in the employee relations department with the responsibility of professional recruiting.

A. W. SISKO graduated from Syracuse university with an AB degree in chemistry in 1942. He received his PhD in physical chemistry from Case Institute of Technology in 1956. He is now senior project chemist in the research and development department of American Oil Co., Whiting, Ind. Dr. Sisko is a member of the Society of Rheology, Sigma Xi and ACS. He has contributed to the NLGI SPOKESMAN previously.

Abstract

Data for the flow of a lubricating grease at different shear rates and temperatures can be placed on a single master curve of relative viscosity against the product of shear rate and shift factor. The equation for the master curve has been derived. The equation permits calculation of grease viscosity at any shear rate and temperature if the oil viscosity and shift factor at the desired temperature are known.

Allen

Raisch

Problems Encountered in Centralized Lubrication Systems at Low Rate of Shear

By A. C. ALLEN, C. F. RAISCH, Stewart-Warner Corp.

A. C. ALLEN worked in the experimental engineering department laboratory of the Graham Paige Motor Co. from 1928 to 1938, during which time he attended the University of Detroit night engineering school. In 1938 he joined Stewart-Warner Corp., where he

is presently employed as research engineer in the new products department. Mr. Allen is a member of SAE.

C. F. Raisch received his mechanical training and a degree in mechanical engineering in Stuttgart, Germany. He was a junior design engineer with Daimler Mercedes, Stuttgart, before coming to the United States in 1924. After working with a research and development group for Stanley steam cars in New York, he joined Bijur Lubricating Corp. in 1925 as an application engineer for centralized automotive lubrication. In 1929 he took a position with the Alemite engineering division of Stewart-Warner Corp. where he progressed from development engineer to project engineer and in 1940 to Alemite chief engineer. In 1947 he was appointed engineering consultant to the manager of engineering. Since 1955 he has been manager of engineering services. Mr. Raisch is chairman of the NLGI subcommittee on grease dispensing in central systems.

Abstract

Paper discusses problems arising in single line centralized lubrication systems with particular emphasis on the difficulties connected with venting time.

Discussion of the means by which some of the lubricant characteristics were observed. Photographs of test equipment, etc.

Portrayal of an unsuspected deviation from the standard form and slope of viscosity vs. shear rate curve in the low shear rate region.

Mention of the probable effect of entrapped air in the lubricant upon over-all system elasticity and storage factor.

Suggestions regarding instrumentation and proposed new instruments to indicate instantaneous values of apparent viscosity.

Zakin

Murray

The Effect of Variations in the Viscosity and Type of the Mineral Oil Component on Oil Separation from Greases of a Lithium-Calcium Soap

By J. L. ZAKIN, G. W. MURRAY, JR., Socony Mobil Oil Co., Inc.

J. L. Zakin received a BS degree in chemical engineering from Cornell university in 1949 and an MS in chemical engineering from Columbia university the following year. After working at the Flintkote Co. research laboratories, he joined Socony Mobil Oil Co.'s research department in 1951 at the Brooklyn laboratory, where he did research and development work on grease and other lubricants. In 1956, he was awarded the Socony Mobil Employee Incentive Fellowship, enabling him to work full-time for the Doctor of Engineering Science degree which he received from New York university in 1959. Dr. Zakin is presently supervising technologist of the grease group in Socony's technical service division. He is a member of Sigma Xi, Phi Lambda Upsilon, ACS, AIChE and the Society of Rheology.

G. W. Murray, Jr., received a BS degree in chemistry from Cornell university in 1925. After two years with National Sugar Refining Co., he joined Standard Oil Co. of New York in 1929. Mr. Murray is presently a senior research technologist in the grease group at Socony Mobil Oil Co.'s Brooklyn laboratory. He has spent most of his 32 years with Socony doing product and process development work on greases, but has also worked in the analytical section and was chief chemist of the Franklin, Pa., plant for 13 years. He is the author or co-author of a number of patents on compositions and processes for the manufacture of lubricating greases.

Abstract

The effects of the viscosity and of the nature of the mineral oil component on the oil separation characteristics of a series of lithium-calcium greases of fixed soap composition were studied. Oil separation data obtained in cone bleeding (210°F) and pressure filtration (7.5 psi) tests fit the empirical equation suggested by Farrington and Humphreys.

$$L = \frac{T}{a + b\,T}$$

where L = oil loss
T = time
a and b are constants with
$\frac{1}{a}$ = a measure of the initial rate of oil loss
$\frac{1}{b}$ = a measure of the ultimate oil loss

The pressure filtration data show a definite trend to decreasing values of $\frac{1}{a}$ with increasing viscosity.

The curve for a paraffinic oil series lies slightly above that for a naphthenic. A similar trend was observed for values of $\frac{1}{b}$, but the distinction between the naphthenic and paraffinic series is less sharp.

The cone bleeding results for the naphthenic oils also show decreasing values of $\frac{1}{a}$ with increasing oil viscosity. The paraffinic curve lies above the naphthenic. The former goes through a minimum. Here $\frac{1}{b}$ values appear to fit a universal curve up to moderate viscosities for all types of oil. This curve goes through a minimum also. At high viscosities it levels off but at higher values for the paraffinic oils than for the naphthenic.

Warren

The Role of Base Oil Viscosities In Performance of Electric Motor Greases

By K. H. WARREN, U. S. Naval Engineering Experiment Station, Annapolis, Md.

K. H. Warren received a BS degree in chemical engineering from the University of Alabama in 1927. After a year as a student engineer at the Westinghouse Electric & Mfg. Co., he returned to the university and received a MS degree in chemical engineering in 1929. Since that time, he has been associated with several chemical process companies engaging in operations, research and pilot plant work on dyestuffs, ceramics, catalysts, ion exchange resins and fermentation products. In 1942 he entered the Army Engineer Corps, serving as an officer in depot and supply work until 1946. He has been engaged in research and development work on lubricants for the U. S. Naval Engineering Experiment Station at Annapolis, Md., since 1952.

Abstract

Important requirements of shipboard greases for electric motors are dispensability at temperatures below normal room temperatures and long performance life in bearings of various sizes with varied DN values, loads and ambient temperatures. Greases which have been formulated with base oils of medium viscosity have best fulfilled these requirements. The effect of base oil viscosity is shown to be an increase in bearing operating temperature with increasing base oil viscosity. A repeatable test method for determining the temperature rise of operating bearings was developed.

Calhoun

The Experience of The Ordnance Corps With Greases Made From Low Viscosity Oils

By S. F. CALHOUN, Rock Island Arsenal

S. F. Calhoun received a BS degree in chemistry from Iowa Wesleyan college and an MS from the State University of Iowa. While in college he served as a research assistant, doing research on chlorination of fatty acids, the ethanol-carbon tetrachloride system and the oxidation of benzene derivatives. He spent a number of years teaching before joining the research department of the Rock Island Arsenal. At present, he is in charge of the petroleum products unit of the laboratory. Mr. Calhoun has done research on synthetic lubricants, grease additives, oil separation from greases, and has worked on missile fuel test equipment. Author of several papers, he is a member of the American Chemical Society.

Abstract

The development of greases designed to lubricate automotive and artillery equipment over the temperature range likely to be encountered in arctic and tropical desert conditions is described. The composition of the original greases which survived the preliminary laboratory screening and started the field testing are given. As the eight-year field test program progressed the changes in soap type from lithium to calcium and the stabilization of the oil viscosity to a range of 65 – 90 SUS/100°F is noted. Improvements in mechanical stability, water resistance and oil separation were made as test results indicated the need. Some special field tests are mentioned and the acceptance of the product by the Armed Forces and industry is noted. ■

Synthesis and Investigation of High Temperature Grease Thickeners

By: J. Q. Griffith, III, Sun Oil Company
and
J. B. Christian, Wright-Patterson Air Force Base

Introduction

The objective of these studies is to develop greases and greaselike materials for utilization under those environments and probable operating parameters imposed upon advanced flight vehicles by the conventional rarified atmosphere and exosphere. These lubricating greases are to provide a highly reliable capability under the following conditions: long term operation at high temperatures (600 to 900°F), wide temperature range utilization including extreme low temperature, high speed and/or heavy load conditions and stability in the presence of high levels of nuclear radiation.

After a thorough review of literature it was decided to concentrate on utilization of imide type compounds for thickeners (Figure 1). These imide compounds offer the following advantages:

a. Ease of "in situ" preparation
b. High thermal stability
c. Versatility of reaction

Oils used in the evaluation of the high temperature thickeners were:

a. Phenoxy Phenyl Ethers
b. Hydrogenated Mineral Oils
c. Liquid Ureas
d. Silphenylenes
e. New Phenyl Silicones (QF-6-7024 and QF-6-7012)

$$(1) \quad (RCO)_2 \ NH$$

$$(2) \quad (RCO)_2 \ NR$$

FIGURE 1—General formula imides.

The following methods of investigation were used to determine the suitability of the imides as high temperature grease thickeners:

a. The preparation of pre-formed thickeners in proper theoretical mole concentrations in solvent. Evaluation of the purified materials consisted of determination of the compounds melting point and particle size.

b. "In Situ" preparation of the thickeners in the base oils such as the ethers, silicones, and mineral oils. Dispersants or solvents were not used in these reactions. The total amount of thickener permitted was 35 per cent (by weight). Molecule dissymmetry was studied in relation to thickening ability of imides.

Imides studied in this work were:

a. Anthraquinone derivatives
b. Pyromellitic dianhydride derivatives
c. Phthalic anhydride derivatives

The most promising extreme temperature thickener system incorporated two separate components—the aluminum complexes of pyromellitimido benzoic acid and phthalimido benzoic acid. The pyromellitic system provides thermal stability and the phthalic system imports excellent gel characteristics and storage stability. The melting point of this combination thickener is above 1200F. Various other amines, such as melamine, aniline, para-phenylenediamine, formamide and amino benzoic acid, have also been evaluated.

The two general types of thickeners are:

a. Interlocking complexes brought together by Al^{+++}, NH_2— or —COOH, etc., (Figure 2).

b. Short entities where the reaction contains small complete molecules.

In addition to the synthesis of the imide compounds, a small proportion of the internal effort was devoted to evaluation of various high melting compounds for use as high temperature grease thickeners. Materials evaluated were:

a. Micro size asbestos
b. Sonicly sheared high temperature resins
c. Ureas
d. Polytetrafluoroethylene powder (PTFE)
e. Commercial—HTG Nos. 1, 2, 3, and 4.

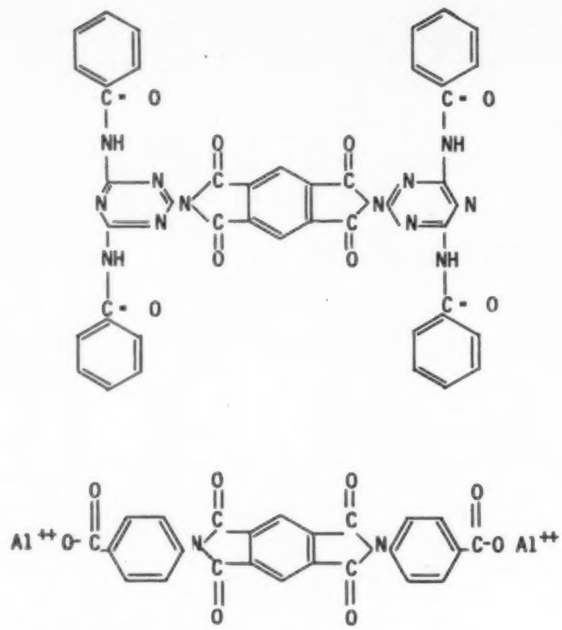


FIGURE 2—Typical imide thickeners.

Discussion

Study of high melting materials such as asbestos, sonicly sheared resins, HTG compounds and the ureas, was divided into two phases. Phase I consisted of determining their thickening ability in various high temperature base oils utilizing various standard techniques such as heating, milling and the use of solvents. Phase II consisted of physical and chemical testing of the greases prepared in Phase I. A complete description of these tests will be given in Part III of this paper since they remained the same for all the greases described above.

The imide compounds were first prepared in solvents which were later removed from the reaction products by evaporation or crystallization procedures. Melting point and particle size determinations were made on the imide solids remaining.

Thickening ability of the imides was judged upon the results of "in situ" reactions in polyphenyl ethers, methyl phenyl silicones, mineral oils, ureas and silphenylenes. "In Situ" reactions consisted of chemically compounding the imides through a controlled reaction or series of reactions using the base fluid as a solvent.

The "in situ" reactions were conducted in an open (500 cc) reaction kettle. All preparations were stirred continuously by a metal paddle stirrer. Heat was applied through a heating mantle controlled by a 1KVA variac. Thermocouples were located between the mantle and kettle and in the reaction mixture. Reactions were controlled by time and temperature of reaction, since early efforts to measure completeness of reactions by condensing and measuring volatile products proved impractical.

Method of Evaluation

a. Visual Inspection. Upon combining liquid and solid components, the resulting mixture was visually observed for formation of a paste or gel structure. If a candidate thickener failed to produce a paste or gel structure after having 35 per cent (by weight) of itself incorporated into a simple grease system (i.e., thickener and base oil) it was dropped from further consideration.

b. Heat Treatment. Greases were heated in open beakers in circulating air oven at temperatures ranging

J. Q. Griffith, III *received a BA degree in chemistry from Amherst college in 1956. A first lieutenant in the U. S. Air Force from 1956 to 1959, he served as a project engineer in the lubricants section of the Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. In 1959, he joined the Sun Oil Co., Marcus Hook, Pa., where he is presently a research chemist in lubricants development. Mr. Griffith is a member of the American Chemical Society and Society of Lubrication Engineers.*

About the Authors

J. B. Christian *received a BS degree in chemistry from the University of Louisville. In 1952, he joined E. I. du Pont de Nemours & Co., Inc., at Charlestown, Ind., as an explosives chemist. From 1954 to 1955 he was a chemist in primary explosives at the U. S. Naval ordnance laboratory, Silver Spring, Md. Since 1955 he has been a research materials engineer (greases) in the nonmetallic materials laboratory at the Aeronautical Systems division, Wright-Patterson Air Force Base, Ohio.*

from 400 to 700F. Greases were examined periodically for physical changes.

c. Milling. Greases were milled three times in a three roll mill at a clearance of 0.002 inch. This procedure served as an excellent primary mechanical stability test.

d. Shell Roll Test. Greases were tested for high temperature shear stability in the Shell Roll Tester. The sample cylinder was revolved at a rate of 80 rpm at temperatures up to 700F. Duration of this test was 24 hours.

e. Evaporation Test. This test was conducted in accordance with ASTM Method D-972-56 except temperatures ranged up to 600°F.

f. Oil Separation Test. This test, of 30 hours duration and at a temperature of 400°F, was conducted in accordance with Federal Test Method Standards No. 791 Method 321.1.

g. Pope Spindle Test. This test was conducted at temperatures as high as 600°F and in accordance with Coordinating Research Council Method L-35.

Evaluation of Miscellaneous Materials

a. Tetraphenyl urea

When 30-40 per cent concentrations of tetraphenyl urea were heated with a silicone fluid, greaselike materials resulted. On milling, these materials were mechanically unstable.

b. Tetrakis (4-biphenyl) urea (See Figure 3)

Tetrakis (4-biphenyl) urea (TU) was recrystallized to obtain a smaller particle size and thereby improve its thickening ability. Dimethyl sulfonamide was chosen as a solvent because the solid was soluble in it at above room temperature. Distilled water was added dropwise to the solution until the solid began to crystallize. Under Leitz microscope the particles were found to be about 30 microns in size or about ½ of their original size.

1. Twenty-eight (28) per cent of TU and a silicone fluid were heated together at 500°F. They proved to be completely incompatible. An acetone dispersant was used to bring about union. After the acetone was evaporated, a paste with a very poor mechanical stability remained. After one week storage, excessive bleeding was noted.

2. A $C_{14}C_{16}$ biphenyl ether grease was made with 30 per cent TU using acetone as a dispersant. A paste grease formed but proved to be mechanically unstable and showed excessive bleeding in short term storage.

3. A pastelike grease with an ASTM penetration of 300 resulted when 30 per cent of TU and hexadecyl triphenyl urea were blended. Again acetone was used as a dispersant. No bleeding was noted after one week shelf storage. On milling the grease fluidized.

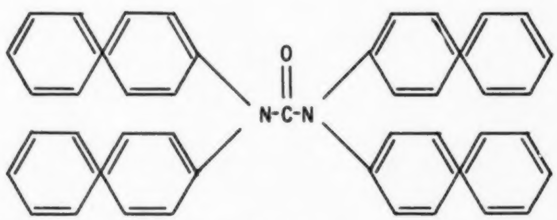


FIGURE 3—Tetrakis (4-biphenyl) urea.

c. PTFE powder

1. Five (5) grams of thickener were required to thicken 4.5 grams of a silicone fluid. Milling was required to bring about a pastelike grease. A solid plasticlike material formed and oil separated out when heated to 550F.

2. In 5.5 grams of hexadecyl triphenyl urea 5 grams of the thickener made a good pastelike grease which showed good mechanical stability on milling. On heating to 500°F, the paste became fluid and the PTFE particles conglomerated, forcing out the oil.

3. In 4 grams of $C_{14}C_{16}$ diphenyl ether 5 grams of PTFE formed a paste which showed evidence of instability at high temperatures.

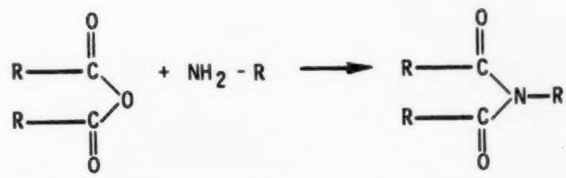


FIGURE 4—Imide grease system.

d. Sonicly Sheared High Temperature Polymer

1. A grease paste was made by blending 3.5 grams of hexadecyl triphenyl urea and 2 grams of the polymer. Heating to 400°F brought about complete solution. On cooling a hard plastic was present. On reheating it softened only to reharden on cooling.

2. Twenty (20) per cent thickener was required to thicken a silicone fluid. After heating to 450F and cooling, the two separated.

3. A good grease was formed when the polymer thickener and $C_{14}C_{16}$ diphenyl ether were united. Heating to 450F was necessary to bring about this grease formation. The ratio of thickener to fluid was 1:2.

e. Micro Particle Size Asbestos

This material was evaluated to determine if it possessed thickening ability. It lacked the high coefficient of friction and high evaporation effects which were experienced with asbestos of a larger particle size.

1. A silicone grease was prepared using 24 per cent thickener. The grease had excellent mechanical stability and a very low evaporation rate. When evaluated in the Pope Spindle at 450°F, 10,000 rpm, failure occurred after 14 hours.

2. An ester grease was prepared using 24 per cent thickener. This grease showed excellent mechanical stability on the Shell 4-Ball Wear Tester (2 hours, 75C, 1200 rpm).

Load	*Wear Scar*
10 Kg	0.6 mm
40 Kg	0.9 mm

f. Commercial High Temperature Grease Thickeners

High Temperature Grease Thickeners Nos. 1, 2, 3, and 4 were evaluated for thickening ability with a silicone fluid. Forty to fifty per cent concentrations were required to bring about thickening. The four greases were placed in an oven at 450F for 24 hours. Afterwards they were milled. Their physical appearance properties are shown in Table I.

TABLE I

Penetration Values of HTG Thickened Greases

	Worked Penetration
HTG No. 1	400
HTG No. 2	340
HTG No. 3	280
HTG No. 4	400

Conclusions

The imide grease system (Figure 4) appeared to be very promising for high temperature application. It is a relatively uncomplicated system and is very adaptable to "in situ" preparations. The by-products of water and alcohol are easily removed from the imide reaction product. The imides have melting points above 1000F and good thickening characteristics. Unlimited numbers of variations of this class of compounds can easily be synthesized.

The only major problem encountered involved the use of imide thickeners with silicone base oils. Upon prolonged storage or being subjected to elevated temperatures, severe hardening of the imide-silicone greases occurred. This hardening was found to be caused by the aluminaum isopropoxide which acted as a gelling catalyst on silicone fluids. This problem is not present in other base fluids such as the phenoxyphenyl ethers or mineral oils.

Some attempts have been made to eliminate the hardening of imide-silicone greases by the substitution of other trivalent ions for that of Al^{+++}, however, the resulting greases were unsatisfactory.

The urea solids, sonicly sheared polymer, HTG thickeners and microsize asbestos proved unsatisfactory as high temperature grease thickeners. The only material which showed adequate thickening ability and shear stability was the microsize asbestos, however, it would not perform satisfactorily in high temperature ball bearing tests. It appears that the asbestos thickener has a high coefficient of friction causing early failure in bearing applications. ■

Calculating Grease Flow in Pipes

By: L. C. Brunstrum
and A. W. Sisko
American Oil Company

Centralized lubricating systems and bulk transportation of greases by truck and pipeline have become increasingly important in the grease industry. Both require calculation of flow rates at various pressures and temperatures. The calculations are complicated, because greases are non-Newtonian fluids and flow data are usually presented as curves. Moreover, the method (ASTM D-1092-58T, "Apparent Viscosity of Lubricating Greases") most often used to obtain the data gives results in metric units, whereas the engineer is interested in English units.

A better method for presenting flow data is by graphs of shear stress, in lbs./in.^{2}, against shear rate, in sec.$^{-1}$. The data are easily obtained from ASTM calculations by use of the conversion factor: 68,944 dynes/cm^2 = 1 lb./in.^{2}. Such flow curves are shown in the figure, for a calcium grease at 0, 32, and 77 F.

Pressure drop per foot of pipe required for a particular flow rate can be calculated either from simple equations or from nomographs based on these equations. For the typical specific gravity of 0.9, the shear rate, $\dot{s}$, in sec.$^{-1}$ is

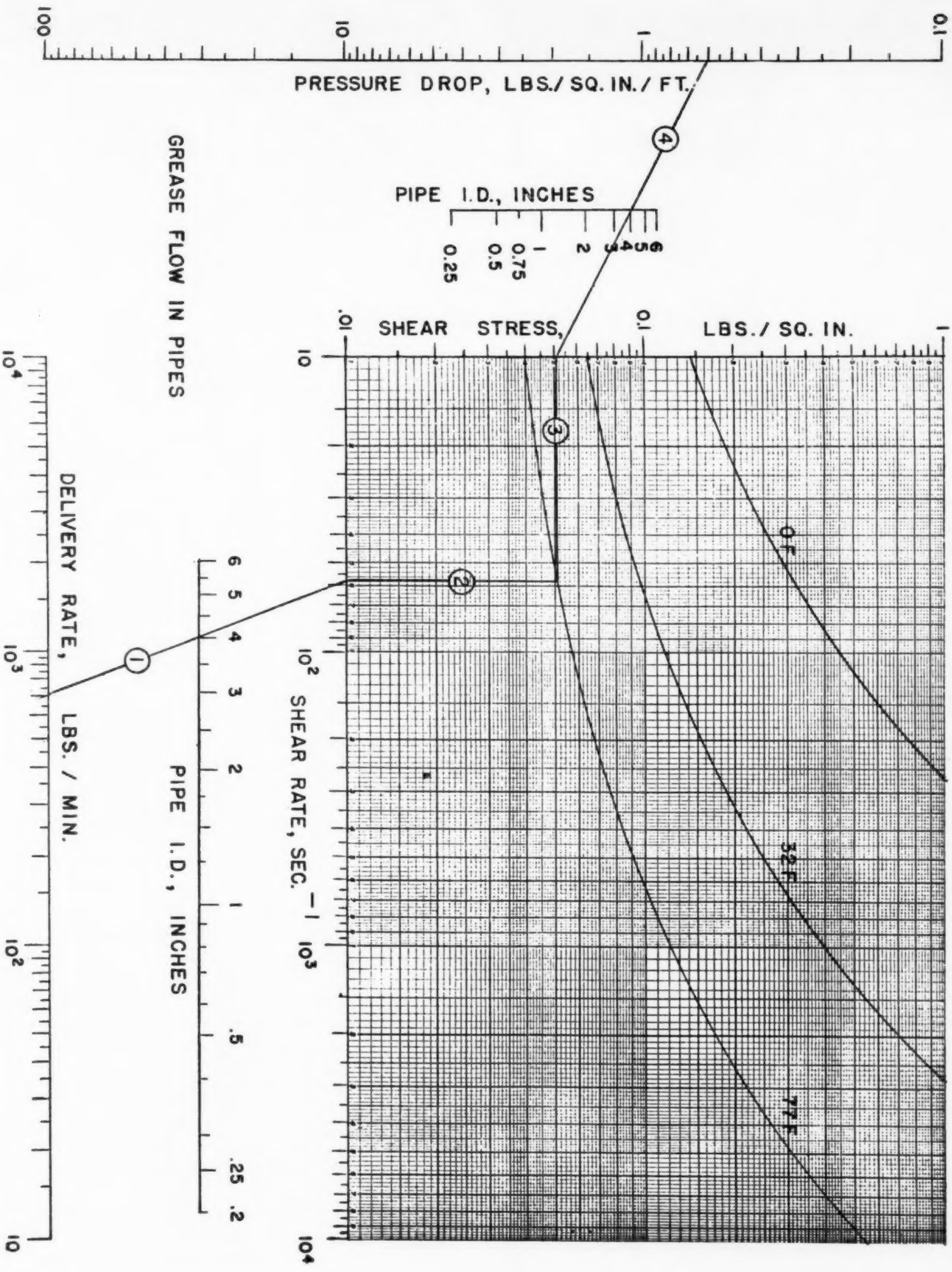
$$\dot{s} = \frac{5.22\ w/m}{d^3}$$

where w/m is the flow rate in lbs./min. and d is the pipe I.D. in inches. Reference to the appropriate flow curve gives the shear stress corresponding to this shear rate. Pressure drop per foot, P/L, is then obtained from

$$\frac{P}{L} = \frac{48\,F}{d}$$

The same operations can be performed with the nomographs shown on the figure. Shear rate is found by extending a line from flow rate through pipe diameter to the shear-rate scale, as line 1. The corresponding shear stress is obtained by following lines 2 and 3. Pressure drop per foot is then determined by extending a line from shear stress through pipe diameter, as line 4. Lines 1 to 4 are a solution to the problem: For this grease, what pressure drop per foot of pipe is required for a flow rate of 700 lbs. per min. in a 4-inch pipe at 77 F?

To calculate the delivery rate corresponding to a given pressure drop, the procedure is reversed. The shear-stress scale may be increased by multiples of 10, provided the pressure-drop scale is similarly multiplied. ■


GREASE FLOW IN PIPES
PRESSURE DROP, LBS./SQ. IN./FT.
PIPE I.D., INCHES
SHEAR STRESS, LBS./SQ. IN.
SHEAR RATE, SEC.$^{-1}$
PIPE I.D., INCHES
DELIVERY RATE, LBS./MIN.
0 F
32 F
77 F

Grease Lubrication

By: R. F. Irwin

Miniature Precision Bearings, Inc.

Reprinted from MPB, "A lubricant manual for instrument ball bearings"

BASICALLY, GREASE is a combination of an oil and a thickening agent. The thickening agent is usually a metallic soap such as calcium, sodium or lithium. An oil may be mixed with more than one metallic soap, resulting in a mixed base grease. The type of metallic soap used influences the consistency, melting point, texture, solubility in water, and heat resistance of the grease. The type of oil used influences the lubricating value of the greases. A grease is usually chosen as the lubricant instead of an oil when the bearing cannot be lubricated frequently, when atmospheric conditions are dirty or when bearings must be run in water.

Calcium-Base Greases

Calcium-base greases can be used in bearings where moderate conditions of temperature and speed exist. This type of grease is particularly suitable if the bearings are to be used in water or wherever moisture is present. Calcium-base greases have a smooth consistency, which makes them suitable for low-torque application.

Lithium-Base Greases

Greases of this type have a combination of good low temperature and good high temperature characteristics, and resistance to the action of water. Many lithium-base greases are manufactured to meet military requirement MIL-G-3278. Because of the variety of properties obtained from this grease, it is generally classified as an all-purpose lubricating grease.

Sodium-Base Greases

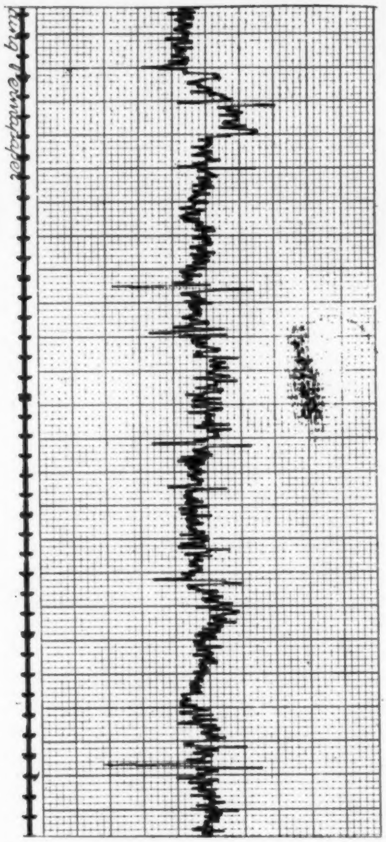
Because of the high melting points of greases of this type, sodium-base greases can give satisfactory service at high temperature. Although they do not have the resistance to water that other types of greases have, they can prevent rusting of steel because of their ability to absorb small amounts of moisture. A great deal of disagreement exists as to the exact temperature limitations for sodium-base greases, but it appears that 300-325°F is the maximum temperature at which this type of grease can be used.

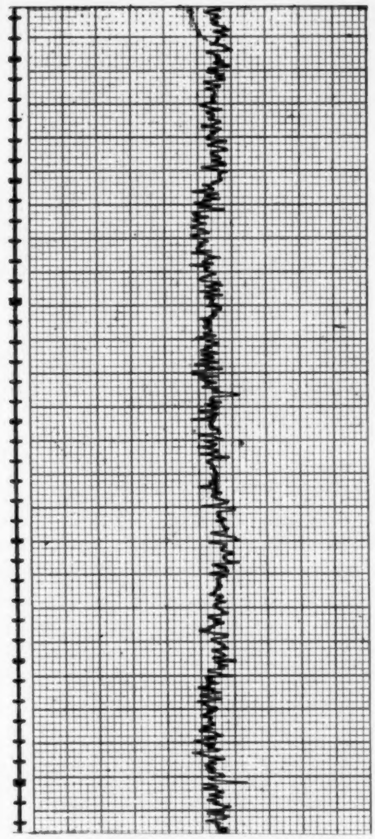
Corrosion of grease lubricated bearings may be caused by either, or both, of the following: (1) the grease may break down to form acids which attack the bearing, or (2) a corrosive atmosphere, such as salt air, attacks the bearing. To prevent this, additives can be included in the formulation of the grease to improve corrosion resistance, rust prevention and stability. If the lubricating oil in the grease has poor oxidation stability, anti-oxidants are added to prevent oxidation. Oxidation stability is directly related to the shelf life of a grease. Although the relationship has never been formulated, it is well known that a grease with poor oxidation stability has a short shelf life. To prevent the second type of corrosion mentioned above, rust inhibitors are added to the grease as in the case of greases required to pass humidity cabinet and salt spray tests.

It is usually desirable to pack the bearing between one-third and one-half full of grease. The running temperature increases with an increase of packing of the free space between the inner and outer race. Although the *amount* of grease put in a bearing is of vital importance, the *condition* of the grease used is just as important.

Greases should always be kept in a closed container so that no dirt can enter. Dirt is harmful to any bearing but particularly so in instrument and miniature bearings.

The majority of failures in bearings of this type is associated with excessive wear. In miniature size ranges, a microscopic dirt particle becomes an appreciable





hazard to torque and wear performance. When bearings are manufactured to very fine tolerances, it is obvious that dirt must be eliminated. Oils usually do not present any dirt problem because they can be easily filtered. Nevertheless, adequate control must be maintained to insure that the oils contain a minimum of dirt.

Greases, on the other hand, present a problem because they cannot be readily filtered. The amounts and particle sizes of dirt permitted in MIL-G-3278 and MIL-G-15793 grease, are far in excess of instrument bearing requirements. Dirt present during grease manufacture is usually increased by the method of packaging. Packaging grease in cans with large openings is not conducive to low dirt count. Illustrated are torque traces of a dirty bearing and a clean bearing. These clearly illustrate the effect of dirt in a bearing.

The shelf life of the grease is another factor which warrants attention. The deterioration of grease due to its reaction with oxygen, has been discussed previously. Because of the small amount of grease needed to lubricate miniature instrument bearings, the likelihood of one container lasting for a year or longer, is great. This leads to deterioration of grease during storage.

The accompanying charts are running torque traces taken on MPB's running torque tester. For the torque trace at the right, each minor division is equivalent to 50 milligram-millimeters. This is a torque trace of a clean bearing having an average running torque of 250 mg. mm. and a peak running torque of 550 mg. mm. The trace at the left represents a dirty bearing. In this case, each minor division is 120 mg. mm. The average running torque of this bearing is 420 mg. mm. and the peak running torque is 2700 mg. mm. Each large "spike" (dots on chart) is caused by a dirt particle in the bearing. The detrimental effect of dirt on torque, especially the peak torque, is clearly illustrated by these comparative torque traces. ■

About the Author

R. F. Irwin *is the laboratory project engineer in charge of metallurgy and chemistry in the research and development laboratory of Miniature Precision Bearings, Inc., Keene, New Hampshire. A metallurgical engineering graduate of Rensselaer Polytechnic Institute, Mr. Irwin has been primarily concerned with the metallurgy and lubrication of miniature bearings, especially under extreme environmental conditions. He has also done considerable research on the heat treatment of SAE* 52100 *and AISI* 440C *steels. Mr. Irwin is a member of the American Society of Metals.*

NLGI AWARD FOR

In June of 1952 Mr. H. L. Hemmingway, now a past president, suggested to the Board of Directors that NLGI create an award for outstanding achievement or service which would honor men who contributed to the growth and development of the Institute. The new award was to differ from NLGI's Honorary Member award, which traditionally goes to retired men, in that it could be given at the time of the service rendered to industry and Institute.

A committee was immediately formed under the chairmanship of Mr. Hemmingway and it reported afterwards that such recognition should be introduced into NLGI procedures and known as the "Award for Achievement," NLGI's highest honor. The Board promptly created the award and the first two recipients, G. W. Miller and T. G. Roehner, were honored at the annual meeting in the fall of 1952.

Since that time six other men have also been singled out for their work. The ceremony honoring each of the eight men has occurred before the entire membership during the banquets of various annual meetings. Each awardee received a handsomely engraved silver tray as the physical reminder of the occasion, and is perpetuated in the memory of NLGI as an outstanding individual.

These men and a brief summary of the work they have been cited for are listed below:

1952 George W. Miller, Battenfeld Grease & Oil Corp., N.Y. Fifth president of the Institute (1937-38), a director from 1934 to 1940, executive secretary on a voluntary basis from 1938 to 1946 and editor of the NLGI Spokesman from its inception in 1937 until a paid executive secretary and editor was hired in 1946, recording secretary (1946-47) . . . Mr. Miller was given the award for his contribution in building and maintaining NLGI in its formative years.

1952 Ted G. Roehner, Socony Mobil Oil Co., Inc. Chairman of the NLGI Technical Committee for twelve years, with great sacrifice of individual time and effort he built and strengthened the committee, devising and expanding committee action to meet increased demands brought about by the growth of the Institute.

1953 Bruce B. Farrington, California Research Corporation. A devoted worker in Technical Committee affairs who developed a number of new techniques and products for the industry. He was particularly honored for his electron microscope investigations into the real structure of lubricating greases.

G. W. Miller

T. G. Roehner

B. B. Farrington

H. B. Fraser

ACHIEVEMENT

1954 HAROLD B. FRASER, International Lubricant Corporation. His many contributions in the formative years of NLGI, followed by developing certain unusual testing equipment and outstanding lubrication work with the military during World War II, earned him recognition. In addition, the Fraser patents on 12-hydroxy stearates are recognized as some of the outstanding patents developed by the industry in many years.

1955 CHARLES J. BONER, Battenfeld Grease & Oil Corp., K.C. The chairman of the Technical subcommittee on editorial procurement for many years, his assistance to NLGI in securing articles and helping in the publication of the NLGI SPOKESMAN, and his contributions towards making the many annual meeting programs a success, were honored. Also, he was recognized for the outstanding contribution he has made to the lubricating grease industry through his book, "Manufacture and Application of Lubricating Greases," published in 1954. This book is considered the finest compilation of authoritative information relative to composition, manufacture and application of lubricating greases to be published in many years.

1956 MARTIN B. CHITTICK, Pure Oil Co. Second president of the Institute (1934-35) and one of the organizers of NLGI. First chairman of the Technical Committee (1936-42), served as a director from 1933 until 1942, when he was called to active duty with the army. Under his chairmanship, the first classification for lubricating greases by penetration range was developed and published, and became universally accepted by the industry.

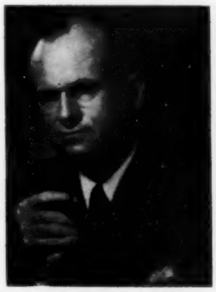
1958 L. C. BRUNSTRUM, American Oil Co. Vice-chairman of the Technical Committee (1955-59), author or co-author of sixteen technical articles in the NLGI SPOKESMAN since 1945, aiding and implementing the progress of the Institute as an outstanding participant for many years.

1959 W. H. SAUNDERS, JR., International Lubricant Corporation. The only one of the three founders still active in the industry, the third president (1935-36), a director continuously since 1934, provided a provisional constitution and bylaws at the first meeting in 1933. He has been a member of or chairmanned every committee ever formed by NLGI. Recognition was given at the completion of his 25th year as an active director, in 1959. ■

C. J. BONER

M. B. CHITTICK

L. C. BRUNSTRUM



W. H. SAUNDERS, JR.

Literature and Patent Abstracts

Additive

Oxidation Inhibitor

According to Cyba and Thompson (U. S. Patent 2,982,729, assigned to Universal Oil Products Co.), addition of 0.001 to 5 per cent of p,p'-diaminodiphenyl ether or p,p'-diisopropylaminodiphenyl ether to soap thickened lubricating greases inhibits the products against oxidation.

The value of such additives is illustrated in the case of a lithium base lubricating grease which when tested in an oxygen bomb at 250°F gave a 5 pound pressure drop in 2 hours. After the addition of 0.3 per cent of the above compounds to two portions of this lubricant, the periods until 5 pound pressure drop at 250°F were 215 and 200 hours. Such additives are also said to deactivate metals but no illustration of such action is given.

Composition

High Temperature Lubricating Greases

Lubricating fluids thickened with copper derivatives of amidine compounds form lubricating greases with dropping points above 500°F. Such mixtures are described by Odell and Lyons in U. S. Patent 2,978,413 assigned to Texaco Inc. Preparation of the lubricants consists of simple mixing. While it is stated that additives may be included, the illustrations do not show that these are used in most cases.

Thus, 33.3 per cent of cuprous N,N' - diphenylformamidine and 66.7 per cent of a 315 SUS at 100°F mineral oil formed a lubricating grease having a dropping point above 500°F and a worked penetration of 345. A product, consisting of 30 per cent of cuprous N,N'-di-(p-nitrophenyl) formamidine and 70 per cent of a silicone oil, lubricated a bearing operating at 700°F for seven hours.

Dripless Oils

Fluid, soap-thickened lubricating oils, useful for textile machinery, contain as thickeners sodium soaps of mixed acids which are by-products from the manufacture of sebacic acid from castor oil. According to Fronczak, U. S. Patent

2,979,458, assigned to the Pure Oil Co., a lubricating grease containing 3 to 20 per cent of soap and 0.3 to 6 per cent of a coupling agent, such as glycerol, is first prepared and homogenized. This is then diluted with further oil to form the desired finished products.

For example, a lubricating grease was formed from 9 per cent of acids known as CD-N, 1.8 per cent of sodium hydroxide, 8.9 per cent of bright stock extract, 79.4 per cent of 200 neutral oil and 0.9 per cent glycerol. When this product was diluted to give a soap per cent of 0.5 to 0.7, it had a viscosity in a No. 4 Ford cup of 75 to 140. To obtain a similar viscosity, 3 to 4 per cent of a calcium tallowate soap was necessary.

High Temperature Lubricating Greases

McGrath and Pellergrini in U. S. Patent 2,979,461, assigned to Gulf Research and Development Co., describe lubricating fluids which are thickened with a mixture of a biphenyldicarboxylic acid and an organophilic clay. Normal preparation of such lubricants consists of mixing at room temperature all of the ingredients and also a dispersing aid for the clay, followed by milling.

A typical composition consisted of 72.25 per cent DC 550 fluid, 24.75 per cent 4,4'-biphenyldicarboxylic acid and 3 per cent Bentone. The resulting lubricating grease had a worked penetration of 324, a dropping point of 450+°F, and a performance life of 457 hours in a bearing operating at 10,000 rpm and 400°F.

Silica Thickened Lubricating Grease

The dispersion of fine silica thickeners in lubricating fluids is aided by the addition of 0.25 to 2.25 per cent by weight of an acid amide. Such use is disclosed by Mertinek, Fronczak and Remes in U. S. Patent 2,980,611, assigned to the Pure Oil Co. Unless used in anhydrous conditions, the addition of Ucon LB550X in an amount equal to the amide is also recommended.

Thus, 91.2 parts by weight of 160 viscosity bright stock were mixed with 0.8 parts of N-methyl acetamide, heated to 190 to 215°F, and 8 parts of Cab-O-Sil added. The temperature was maintained for 90 minutes after which the mass was milled. The finished lubricant had a worked penetration of 239.

Water-Resistant Non-Soap Lubricating Greases

Lubricating fluids thickened with fine silica are rendered resistant to water by the addition of 0.1 to 10 per cent of a sorbitan derivative having a hydrophil-lipophile balance value between 9 and 12. After this addition the mixture should be heated to 250°F. Such combinations are described by Potter in U. S. Patent 2,980,612, assigned to Union Oil Co. of California. The waterproofing agent can be added to the oil before or after the addition of the silica.

Where 9 parts of Cab-O-Sil, 1 part of polyoxyethylene sorbitan tristearate (Tween 65) and 90 parts of an oil having a V.I. of 86 and viscosity of 52.5 SUS at 210°F were used, a product with a penetration of 260 resulted. In a boiling water test, there was no tendency to breakdown or emulsify. The lubricant was also reversible showing the same penetration after being heated to 320°F, cooled and worked.

Lubricants Thickened With Metal Salts of Half Esters of Substituted Dicarboxylic Acids

Morway and Bartlett in U. S. Patent 2,980,615, assigned to Esso Research and Engineering Co., describe lubricating greases thickened with metal salts of a half ester of either an alkenyl succinic acid or an alkenyl methyl succinic acid. Such salts, present in a proportion of 5 to 40 per cent, may be the sole thickener or they may form a portion of a complex in which both soaps of high molecular weight fatty acids and a salt of acetic acid are present.

For example, a 1-liter flask was charged with 120 grams of C_{13} Oxo alcohol and 193 grams of commercial hexadecenyl succinic anhydride. The mixture was heated on a steam bath for 2.5 hours to give a half ester used in the following formulation. Ten per cent each of Hydrofol acids 51 and of the half ester of hexadecenyl succinic acid were charged to a kettle with 69 per cent of a naphthenic type oil having a viscosity of 50 SUS at 210°F. After warming this mixture to 130°F, 4 per cent of glacial acetic acid was added followed immediately by 6 per cent of sodium hydroxide as a 40 per cent water solution. Heating was then continued first to dehydrate the mass and then to 500°F for about 1¼ hours. Thereafter the composition was cooled to 250°F where 1 per cent of phenyl alpha naphthylamine was added. After further cooling to 200°F, the lubricant was passed through a Gaulin homogenizer. The resulting lubricating grease had a worked penetration of 290, a dropping point of 475+ and a loss on a water wash out test of 5.0 per cent.

Rust-Inhibited Lubricating Greases

Rust preventive properties are contributed to soap-thickened lubricating greases by the addition of 1 to 10 per cent of formamide, according to Knowles, Odell and Lyons (see U. S. Patent 2,980,616, assigned to Texaco Inc.) A suggested method of addition of this compound is to add it to the finished lubricating grease while at room temperature followed by heating to 150°F and maintaining this temperature for 30 minutes with stirring.

Thus a calcium base product which permitted rusting was changed to one preventing rust after the addition of 1 per cent of formamide. Use of 5 per cent of

formamide in a lithium base product served a similar function. However, such additions both softened the lubricant and lowered the dropping point.

Non-Soap Thickened Lubricating Greases

In British Patent 848,054 N.V. de Bataadsche Petroleum Maatschappis describes lubricating greases in which the gelling agents consist of clays containing adsorbed dyes. Thus, 4.2 parts of a hectorite clay were dispersed in water to form a 2 per cent suspension. Then 3.4 parts of indigo powder and 0.25 part of phosphoric acid were added and the mixture was heated to boiling, forming a soft gel. To this mass 92.15 parts of bright stock and also isopropyl alcohol equivalent to 6 parts per part of water present, were added. The finished lubricating grease was then formed by dehydrating the mixture in a thin-film dryer, drying in an oven at 450°F and milling. The method may be used with either mineral or synthetic fluids and various types of clays or dyes.

Lubricating Greases Thickened with Mixtures of Lithium Soaps and Lithium Dilinoleate

By using a mixture of lithium soaps derived from conventional high molecular weight fatty acids and dimer acids, Eckert and Thomas (U. S. 2,983,680, assigned to Texaco Inc.) claim that oils can be thickened to lubricating greases which are shear stable and resistant to water. The preferred ratio of the two lithium compounds is one to one.

A typical product was made by mixing 245 grams of triple-pressed stearic acid, 245 grams of dimer acid, 382 grams of a ten per cent lithium hydroxide solution, 500 grams of an oil having a viscosity of 312 SUS at 100°F, and 500 grams of water. The mass was heated for one hour at 210° F and then for an additional hour at 310°F, where 500 grams more oil were added while maintaining this heat. Next, the

mixture was cooled to 210°F while 500 grams more oil were added and finally 10 grams of phenyl alpha naphthylamine before milling. The finished lubricating grease had a dropping point of 376°F, penetrations of 332 after 60 strokes and 354 after 100,000 strokes, and five per cent loss in a dynamic water resistance test.

Lubricating Greases Containing a Mixture of a Tetraphenylphthalyl Compound and an Organophilic Siliceous Compound as Thickeners

Halter and McGrath in U. S. Patent 2,983,682, assigned to Gulf Research and Development Co., describe certain lubricating greases which are useful at high temperatures. These consist of fluids such as silicone oils or diesters thickened with a mixture of an organophilic siliceous material and tetraphenylphthalic acid or derivatives thereof. A mixture can be made of all the ingredients at room temperature followed by milling to give the finished product.

Thus, the following parts by weight of components were used: 30 of G. E. Silicone 81717; 30 of DC 550 Fluid; 37 of mono-isooctyl tetraphenylphthalate; and 3 of Bentone. The resulting lubricating grease had a worked penetration of 298, a dropping point of 450+°F, and a performance life of 928 hours in a bearing operating at 400°F and 10,000 rpm.

Clay Base Lubricating Greases

Clay base lubricating greases having water resistance and also resistance to deterioration in the presence of ionizing radiation are formed if the clay has absorbed on the surfaces a hydrophobing amount of asphaltenes. Such products are described by Loeffler in U. S. Patent 2,981,685, assigned to Shell Oil Co. Bright stock is the preferable fluid for these lubricants. The clay used should be one with a high base-exchange capacity such as Wyoming bentonite or hectorite. The asphaltenes are preferably oxidized after which they are separated

from other asphaltic constituents by precipitation. Such asphaltenes dissolved in an aromatic solvent can then be added to the lubricating oil before or after the introduction of the colloidal clay.

Two lubricating greases were prepared from the same bright stock and hectorite clay. In one case 5 per cent of the clay and 3 per cent of an amino amide hydrophober was used to give a product with a worked penetration of 260 which changed to 285 after exposure to 10^8 rads irradiation. A similar product containing 4 per cent clay and 3 per cent asphaltenes changed in worked penetration from 291 to 310. However, when tested in a bearing operating at 300°F and and 10,000 rpm, the first lubricant ran 562 hours to failure while the last lubricant ran 378 hours.

Process

Mechanically Stable Lithium Base Lubricating Greases

According to Borg and Leet (U. S. Patent 2,980,614, assigned to Standard Oil Co., Indiana), lithium base lubricating greases with superior mechanical stability and resistance to oil separation are formed by first preparing two lots of lubricating grease and then blending the two. The thickeners consist respectively of stable short soap fibers and metastable microfibers.

The Literature and Patent Abstracts column is written for NLGI by C. J. Boner, chief research chemist for Battenfeld Grease and Oil of Kansas City, Missouri.

The first type of fibers has a fiber length between 1 and 10 microns and an average ratio of fiber length to fiber width between 17 and 26. Such soap structure is obtained by saponifying hydrogenated castor oil with lithium hydroxide in the presence of oil, heating the soap-oil mixture until complete dispersion results, holding the mass in the transition range of about 360 to 400°F for at least one hour, slowly cooling the mixture to 200 to 275°F, and milling. The metastable soap structure is obtained by neutralizing 12-hydroxystearic acid with lithium hydroxide in the presence of oil, heating to a temperature giving complete dispersion of the soap in the oil, shock chilling to a temperature within the range of 100 to 150°F, and milling.

The two types of lubricating grease can be blended in a ratio between 1:3 and 3:1, heated to 150 to 200°F, and milled to give the finished lubricant. The change in characteristics of typical lots is shown in the Table below.

Table

Type of Soap Fibers	*Metastable*	*Short*	50/50 *Blend*
Soap, wt. Percent	7.0	7.0	7.0
No. Millings	2	2	2
L/W	12.8	22.1	17.3
Penetrations:			
Unworked	296	301	295
60 Strokes	296	295	284
100,000 Strokes	378	342	328
Roll Stability, 77°F:			
Before	265	282	263
After	361	337	297
Percent Change	35.8	19.5	12.9
Leakage:			
Oven	2.53	3.9	3.41
RIA	3.00	10.55	4.45

NLGI Associate, Technical

CONTAINER AND CLOSURE MANUFACTURERS

American Can Company
4810 Belleview, Kansas City 12, Mo.
Representative—H. T. Rich

American Flange & Manufacturing Company, Inc.
30 Rockefeller Plaza, New York 20, N. Y.
Representative—Richard L. Parish, Jr.

Bennett Industries
Peotone, Illinois
Representative—S. A. Bennett

Central Can Company, Inc.
3200 South Kilbourn Ave., Chicago 23, Ill.
Representative—Henry Frazin

Cleveland Container Company
4919 So. Halstead St., Chicago 9, Ill.
Representative—R. D. Sayles

Continental Can Company, Inc.
633 Third Ave., New York 17, N. Y.
Representative—W. J. Flint

Geuder, Paeschke & Frey Company
324 North Fifteenth St., Milwaukee 1, Wis.
Representative—Neil Savee

Greif Brothers Cooperage Corp.
1821 University Ave., St. Paul 4, Minn.
Representative—Ray Suttle

Inland Steel Container Company
6532 South Menard Ave., Chicago 38, Ill.
Representative—J. Daniel Ray

Jones & Laughlin Steel Corporation
Container Division
3 Gateway Center, Pittsburgh 30, Pa.
Representative—J. E. Morris

National Steel Container Corp.
6700 South LeClaire Ave., Chicago 38, Ill.
Representative—Henry Rudy

The Ohio Corrugating Company
917 Roanoke Ave. S. E., Warren, Ohio
Representative—Lawrence F. McKay

R. C. Can Company
9430 Page Ave., St. Louis 32, Mo.
Representative—Harry H. Ellerbrock

Republic Steel Corporation
Container Division
465 Walnut Street, Niles, Ohio
Representative—Theodore Humphrey

Rheem Manufacturing Company
400 Park Ave., New York 22, N. Y.
Representative—G. Gwyn Tucker

Rieke Metal Products Corporation
Auburn, Indiana
Representative—Raymond F. Ouer

Sefton Fibre Can Company
Div. Container Corp. of America
3275 Big Bend Blvd., St. Louis, Mo.
Representative—W. V. Swofford

Southline Metal Products Company
3777 West 12th Street, Houston 24, Tex.
Representative—Warren F. Wackman

Steel Package Division of National Lead Company
722 Chestnut Street, St. Louis 1, Mo.
Representative—Warren T. Trask

Thatcher Glass Mfg. Co., Inc.
Plastic Container Division
375 Park Ave., New York 22, N. Y.
Representative—Henry E. Griffith

United States Steel Products
Division, United States Steel Corporation
30 Rockefeller Plaza, New York 20, N. Y.
Representative—C. R. Justice

Vulcan-Associated Container Companies, Inc.
P. O. Box 161, Bellwood, Ill.
Representative—V. I. McCarthy, Jr.

ENGINEERING SERVICES

The C. W. Nofsinger Company
307 East 63rd Street, Kansas City 13, Mo.
Representative—C. W. Nofsinger

Sumner Sollitt Co.
307 N. Michigan Ave., Chicago 1, Ill.
Representative—A. J. Barth

MANUFACTURERS OF EQUIPMENT FOR APPLICATION OF LUBRICATING GREASES

Balcrank, Inc.
Disney near Marburg, Cincinnati 9, Ohio
Representative—Richard P. Field

The Farval Division Eaton Manufacturing Co.
3249 East 80th St., Cleveland, Ohio
Representative—E. J. Gesdorf

Gray Company, Inc.
60 Northeast 11th Ave., Minneapolis 13, Minn.
Representative—B. A. Beaver

Lincoln Engineering Division McNeil Machine & Engineering Co.
4010 Goodfellow Ave., St. Louis 20, Mo.
Representative—R. E. Crean

Stewart-Warner Corporation
Alemite Division
1826 Diversey Parkway, Chicago 14, Ill.
Representative—E. G. Wicklatz

MARKETING ORGANIZATIONS

Ampol Petroleum, Ltd.
Buchanan Street
Balmain, New South Wales, Australia
Representative—M. E. Brownell

California-Texas Oil Company
380 Madison Ave., New York 17, N. Y.
Representative—Hal U. Fisher

Canadian Petrofina Limited
505 Dorchester Boulevard West
Montreal, Quebec, Canada
Representative—M. E. Wight

Cooperative GLF Exchange, Inc.
Terrace Hill, Ithaca, N. Y.
Representative—W. S. Miller

Denco Petroleum Company
5115 Denison Avenue, Cleveland 2, Ohio
Representative—E. E. Busse

Derby Refining Co.
202 West First St., Wichita, Kan.
Representative—W. B. Neil

D-X Sunray Oil Company
Mid-Continent Bldg., P. O. Box 381, Tulsa, Okla.
Representative—J. W. Basore

Farmer's Union Central Exch., Inc.
P. O. Box G, St. Paul 1, Minn.
Representative—H. F. Wagner

Illinois Farm Supply Company
P. O. Box 585, Bloomington, Ill.
Representative—S. F. Graham

Lubrication Engineers, Inc.
2805-11 Race St., Fort Worth 11, Texas
Representative—James P. Bell

M.F.A. Oil Company
P. O. Box 510, Columbia, Mo.
Representative—Stuart L. Spradling

Pennsylvania Refining Company
2686 Lisbon Road, Cleveland 4, Ohio
Representative—Ben Sollitto

United Co-Operatives, Inc.
111 Glamorgan, Alliance, Ohio
Representative—A. J. Miller

and Marketing Members

Valvoline Oil Company
Division of Ashland Oil & Refining Co.
Box G, Freedom, Penna.
Representative—R. L. Sailer

REFINERS

Henry H. Cross Company
600 South Michigan Ave., Chicago 5, Ill.
Representative—J. N. Waddell

SUPPLIERS OF EQUIPMENT FOR MANUFACTURING LUBRICATING GREASES

Barrett Manufacturing Company
P. O. Box 8096, Houston 4, Texas
Representative—George J. Barrett, Jr.

Chemicolloid Laboratories, Inc.
55 Herricks Road, Garden City Park, N. Y.
Representative—David F. O'Keefe

Girdler Process Equipment Division, Chemetron Corp.
2820 West Broadway, Louisville, Ky.
Representative—J. E. Slaughter, Jr.

Stratford Engineering Corporation
612 W. 47th Street, Kansas City 12, Mo.
Representative—D. H. Putney

H. W. Stratford Company, Inc.
1701 Bryant Bldg., Kansas City, Mo.
Representative—H. W. Stratford

Struthers Wells Corp.
1003 Pennsylvania Ave. West, Warren, Pa.
Representative—K. G. Timm

SUPPLIERS OF MATERIALS FOR MANUFACTURING LUBRICATING GREASES

American Potash & Chemical Corp.
99 Park Avenue, New York 16, N. Y.
Representative—W. F. O'Brien

Archer-Daniels-Midland Company
Industrial Chemicals Division
P. O. Box 532, Minneapolis 40, Minn.
Representative—J. H. Kane

The Baker Castor Oil Company
Bayonne, N. J.
Representative—J. W. Hayes

Baroid Chemicals, Inc.
A subsidiary of National Lead Company
1809 South Coast Life Building
Houston 2, Texas
Representative—C. M. Finlayson

Cabot Corporation
141 W. Jackson Blvd., Chicago, Ill.
Representative—Warren M. Parsons

Climax Molybdenum Company
1270 Avenue of the Americas, New York 20, N. Y.
Representative—K. B. Wood, Jr.

Darling & Company
4201 South Ashland Ave., Chicago 9, Ill.
Representative—L. Strauf

E. I. du Pont de Nemours & Company, Inc.
Wilmington 98, Delaware
Representative—Joseph J. Mikita

The Elco Lubricant Corporation
Jennings Road & Denison Avenue
Cleveland 9, Ohio
Representative—R. K. Smith

Emery Industries, Inc.
4300 Carew Tower, Cincinnati 2, Ohio
Representative—David R. Eagleson

Enjay Chemical Company
Div., Humble Oil & Refining Co.
15 West 51st St., New York 19, N. Y.
Representative—Stephen L. Wythe

Foote Mineral Company
18 W. Chelten Ave., Philadelphia 44, Penna.
Representative—W. M. Raynor

A. Gross and Company
295 Madison Avenue, New York 17, N. Y.
Representative—Eugene W. Adams

Harchem Division Wallace & Tiernan, Inc.
25 Main St., Belleville, N. J.
Representative—H. M. Abbott

Humko—Chemical Department
P. O. Box 398, Memphis 7, Tenn.
Representative—W. J. O'Connell

Lithium Corporation of America, Inc.
500 Fifth Ave., New York 36, N. Y.
Representative—M. Malcolm Moore

The Lubrizol Corporation
Box 3057—Euclid Station, Cleveland 17, Ohio
Representative—J. B. Irwin

Mallinckrodt Chemical Works
2nd & Mallinckrodt Sts., St. Louis 7, Mo.
Representative—John A. Caughlin

Monsanto Chemical Company
800 North Lindbergh Blvd., St. Louis 66, Mo.
Representative—J. W. Newcombe

Newridge Chemical Company
7025 West 66th Place, Chicago 38, Ill.
Representative—T. E. Shine

M. W. Parsons—Plymouth, Inc.
59 Beekman St., New York City 38, N. Y.
Representative—Herbert Bye

Werner G. Smith, Inc.
1730 Train Avenue, Cleveland 13, Ohio
Representative—W. Meckes, Jr.

Swift & Company
165th & Indianapolis Blvd., Hammond, Ind.
Representative—F. H. Beneker

Synthetic Products Company
1636 Wayside Rd., Cleveland 12, Ohio
Representative—Garry B. Curtiss

TECHNICAL AND RESEARCH ORGANIZATIONS

Battelle Memorial Institute
505 King Avenue, Columbus 1, Ohio
Representative—R. L. Jentgen

The Chek-Chart Corporation
222 West Adams St., Chicago 6, Ill.
Representative—H. Eldridge

Chemico (Pty.) Ltd.
Miller and 7th Streets, P. O. Box 6349,
New Doornfontein, Johannesburg,
South Africa
Representative—O. Richter

Compagnie Francaise de Raffinage Direction Recherches et Procedes
22, Rue Boileau, Paris (16e) France
Representative—Albert E. Miller

Institut Francais du Petrole
CMR—Courtel, 4 Place Bir Hackeim
Rueil—Malmaison (S. et Oise) France

LABOFINA S. A. Centre de Recherches du Groupe PETROFINA
Bruxelles 12, Belgium
Representative—R. Gillerot

Phoenix Chemical Laboratory, Inc.
3953 Shakespeare Ave., Chicago 47, Ill.
Representative—Mrs. G. A. Krawetz

People in the Industry

Ole Berg, Jr.

Mr. Ole Berg, Jr., well-known oil executive, passed away in the St. Agnes hospital, Fresno, California, from a heart attack Sunday morning, September 3. Private funeral services were held Tuesday, September 5.

Mr. Berg was associated with BA and Sunland Refining during his career with the industry.

Dr. Leonard W. Doolan

Funeral services for Dr. Leonard W. Doolan, 54, manager of Tidewater Oil Co's. eastern division lubricants supply department and a member of the division's council of executives, were held Sept. 6 at the Memorial funeral home, Plainfield, N. J.

Dr. Doolan, associated with Tidewater for more than 25 years, died September 3 at his home in Scotch Plains, N.J. after an illness of several months.

A native of Waco, Tex., he received his bachelor of science and masters degrees from Yale university and his Ph.D. from Sheffield Scientific school, Yale. He joined Tidewater in 1935 as a development engineer at the company's former Bayonne refinery where successive promotions brought him to supervisor of the process control department. Transferred to division headquarters in New York City, he became assistant to the vice-president in charge of manufacturing and in mid-1957 was named to his most recent post.

Dr. Doolan was a member of the American Petroleum Institute, the National Lubricating Grease Institute, the Executives club and the Metropolitan club, of New York.

Named to Humble's Headquarters Staff

James B. Smith, manager of lubrication and commercial sales for the Esso Standard region, Humble Oil & Refining Co., has been named coordinator of lubricating and process oil sales in the new headquarters marketing department of Humble in Houston, Tex.

He will move to Texas from the Esso headquarters in New York City where he has headed the lubrication and commercial sales division in the Esso Standard marketing department since 1958. His appointment to Humble's headquarters staff is effective immediately.

A native of South Hill, Va., Mr. Smith was graduated from Virginia Polytechnic Institute with a bachelor of science degree in engineering in 1943 and joined Esso in 1946, after two years of Navy duty with destroyer escort vessels in the Atlantic.

He was assigned to the sales engineering division at the New York City headquarters when he joined Esso.

After assignments relating to automotive fuels and wax problems, and service as liaison between Esso sales engineering and equipment manufacturers on new fuel and lubricant development projects, Mr. Smith was named a group head—for automotive products—in 1953. He became head of the section responsible for automotive and aviation product quality later the same year.

For another two years, beginning in 1955, he served in the field as manager of lubrication sales for Esso's New Jersey area and as manager of industrial sales for New York State.

He returned to Esso headquarters four years ago as assistant to the manager of consumer sales, was named an industrial sales coordinator in December, 1957, and served in that post until he was appointed manager of the lubrication and consumer sales division three years ago.

A member of the American Petroleum Institute, Mr. Smith is active on its lubrication committee and on subcommittees and panels surveying lubrication problems.

Appointed Director Of Market Research

Charles J. Wiley has been appointed director, market research of Amoco Chemicals Corp., George Rieger, manager of market research and development, announced.

Wiley joined Amoco Chemicals recently from Callery Chemical

Co. where he was manager of marketing services. Prior to this, he had held various technical and marketing positions with Nalco Chemical Co., Sharpe & Dohme division of Merck & Co., Inc. and Foote Chemical Co. He holds an A.B. degree from the University of Pennsylvania and an M.S. degree from the University of Massachusetts. He is a member of the American Chemical Society, the American Rocket Society and an associate member of Sigma Xi.

Two Managers Named by Shell Chemical Company

John F. Kroeger, Shell Chemical Co.'s industrial chemicals sales manager, has announced the appointment of two West Coast district managers.

Jan S. Oostermeyer was named manager of the Los Angeles industrial chemical district. Thomas H. Butler was appointed manager of the San Francisco district. Both men were formerly on the sales staff in Shell's New York offices.

Mr. Oostermeyer joined Shell Chemical as a junior chemist in 1951 at the company's Martinez plant. He later worked in product development at the technical services laboratory at Union, N.J., and as a technical salesman in the Detroit and Cleveland districts. He is a graduate of the University of San Francisco.

Mr. Butler is a graduate of Fordham university. He joined Shell Chemical in 1952 as a junior chemist at the Union laboratory. He later worked as a technical salesman in New York and as a member of the sales development department.

ADM Promotes Calvin L. Immel

Calvin L. Immel, sales representative for Archer-Daniels-Midland Co. in the Philadelphia area, has been promoted to technical specialist in the company's specialty chemicals department in Minneapolis. His transfer is effective September 1.

ADM's specialty chemicals department markets the company's lines of fatty nitrogens, fatty alcohols, olefins and hydrocarbons. R. G. Freese is manager of the department.

Immel joined ADM as a chemist in the central research laboratory in Minneapolis in 1955 and was assigned to the Philadelphia sales office the next year. He is a graduate of Indiana university with a bachelor's degree in chemistry and a master's degree in business administration.

Joins Joseph Dixon Sales Force

Gregory P. Cordones, Neptune, N. J., has joined the sales force of the Joseph Dixon Crucible Co., Jersey City, N. J. He will represent the company's paint, graphite and lubricants divisions in the state of New Jersey, replacing Harvey M. Ragan who will groom Mr. Cordones until the former's retirement in the fall.

Cordones has had a wealth of sales, sales promotion and marketing experience in the industrial field, having worked for Clark Equipment Co., Aeroquip Corp., Pfaff & Kendall Co., and for Linde Products Co. He is a graduate of Newark (N.J.) Central High School; Ithaca college where he received a B.S. in education in 1953; Newark college of engineering where he studied sales engineering; Dun & Bradstreet business school where he studied credit and financial analysis and the Sales Education Institute.

Esso Standard Names Summers to New Post

The Esso Standard region, Humble Oil & Refining Co., has named Frank M. Summers as manager of national, commercial and lubricant sales, a newly-created position.

Since 1958 Mr. Summers has been assistant manager of the lubrication and commercial sales division at Esso Standard headquarters in New York City. He will head those same marketing activities in his new assignment, and also will be responsible for national account sales.

Edward V. Dorr was previously manager of national account sales

for Esso, and James B. Smith was manager of lubrication and commercial sales. They were recently named coordinators in Humble's new headquarters marketing department in Houston—Mr. Dorr for national accounts and government sales, and Mr. Smith for lubricating and process oil sales.

Mr. Summers, a graduate of the University of Georgia, entered the oil business in Tennessee in 1934, joined Esso Standard in 1942 and by 1949 had advanced to the managership of the Knoxville District. After 3½ years in the Tennessee-Arkansas sales headquarters at Memphis, serving as assistant to the operations manager and as manager of employee relations and public relations, he moved to New York City in 1956 as assistant manager of national account sales.

Humble Oil & Refining Company is the principal operating affiliate of Standard Oil Company (New Jersey).

Industry News

ASME Moves Its Headquarters

The American Society of Mechanical Engineers moved its headquarters' offices on September 2, 1961, to the recently completed United Engineering center. Official address of the center, which occupies the block on United Nations plaza between 47th and 48th streets in Manhattan, will be 345 East 47th Street, New York 17, New York.

The 50,000-member society, which employs a headquarters staff of 140, occupies the fifth, sixth and seventh floors. Other floors will be occupied by eighteen other engineering societies, all non-profit groups devoted to disseminating information and similar non-commercial activities.

ASME, which for 55 years has been housed in the Engineering Societies building, was founded in 1880.

New Booklet Offered by Battelle

"Can the Research Scientist Acquire a Management Attitude?" is the title of, and the basic question underlying, a printed discussion now being offered by Battelle Memorial Institute to representatives of industry concerned with research and development. Written by M. R. Nestor, Battelle's manager of project development, the statement is one of a series on the procedures and characteristics of contract research for industry being published by the Columbus, Ohio, research center.

In this statement, Nestor makes the point that industrial management people and research professionals have much in common, including a high degree of creativeness. Industry's practical needs and the professional's desire for creative freedom are compatible, he asserts.

Case histories are cited in which the research professional's suggestions for work in areas not previously considered are applauded by management men responsible for their company's research and development activities. Much initiative is encouraged, according to Nestor.

The Battelle spokesman reports that the average research professional wants to see the results of his work applied to industrial production and social betterment. For this reason, he acquires a feel for economics and will not recommend proposed research projects, if technological and market factors indicate that the research effort will not fill a real need.

New Packaging Research Laboratory at Rheem

Rheem Manufacturing company's container division has opened a new research and technical service center in a separate building at division headquarters in Linden, N. J., according to W. S. Goodfellow, vice-president and general manager. Research and development operations formerly were located at the division's Chicago plant.

"Our enlarged staff and facilities at Linden will expand the company's studies of new processes and techniques for the application of interior and exterior coatings to the containers produced by the division. Basic research and evaluation of new packages will also be undertaken in the laboratory," Mr. Goodfellow said.

These activities are coordinated with the expanded and intensified technical services of eight Rheem container producing plants across the country to individualize customer service programs on a local

basis. Rheem container division plants are located at Linden, N. J.; Chicago; Houston and Freeport, Tex.; Tacoma, Wash.; New Orleans; and Richmond and South Gate, Calif.

R-C Can Company Introduces Improved Grease Gun

Centering even greater attention on positive seal, R-C Can company has added a new feature to its E-Zee Loader disposable grease gun cartridge and is now in large-scale production of the improved model.

The new seal consists of a lamination of mylar polyester film and aluminum foil that is so tough it withstands rough handling and maintains a strong leakproof closure. This foil segment is a recessed inner circle in the reinforced metal bottom of the cartridge seamed between bottom and body as an integral part of the container. The recess gives extra protection against surface scuffs and chance puncture.

While this makes a very rugged seal, opening for use is simple with a knife, screwdriver, or even a pointed stick. The mylar foil doesn't fray so there are no particles to clog the gun or get into lubricating systems.

E-Zee Loader is constructed of a spirally wound kraft body and a grease-proof liner. If desired, a multi-color, aluminum foil label can be supplied at low cost. This preprinted label is spirally applied in the container winding process. Thus it becomes a lasting label that is actually an integral part of the cartridge body adding extra strength as well as attractive appearance.

Two types of closures are available. One is the inverted slip cover. The other is a long-skirted and beaded slip cover. In standard size the E-Z Loader is 2⅛₂" I.D. and $9\frac{9}{32}$" O.H. It holds 14 ounces of grease.

R-C is now supplying these cartridges to major companies. Because the spiral-winding process developed by the R-C Can Company permits much higher speed production the company has manufacturing capacity to fulfill any quantity requirement.

Chek-Chart's Detroit Office Moves

The Detroit engineering office of the Chek-Chart Corp., located for more than 25 years in the General Motors Bldg., moved to new and larger quarters September 1. The new address is 11000 West McNichols Road.

Relocation of the office is designed to provide greater flexibility and to facilitate ease of inspection by Chek-Chart engineers of new cars produced in all automobile plants in the Detroit and Canadian area, according to Robert J. Mahaffay, director of engineering for the corporation.

Since 1929 Chek-Chart has been compiling and publishing authentic automotive service and lubrication data for the petroleum industry in the United States and Canada. Working closely with the car manufacturers, Chek-Chart engineers annually inspect every new model and make, pinpointing every lubricating fitting and providing service and tune-up procedures for the use of service stations in the two countries.

The inspection team is headed by manager James C. Baker, well-known in automotive service circles for many years. The staff includes field engineers G. F. Hollenbach and Richard Johnson. Johnson, former Ford Motor Co. technical writer and statistician, recently was added in an expansion of the Detroit office's activities.

New Process for Manufacture of Critical Specification Lubricants

"Twenty-one months of research and development have paid off with a completely new process for the manufacture of critical specification lubricants. The Electro-Thermatic t. m. process gives Southwest control and automation never before possible in the manufacture of highly technical specification products," H. A. Mayor, Jr., executive vice-president of Southwest Grease and Oil company, stated recently.

W. L. Pannell, vice-president of production, was equally enthusiastic: "After four months of operations, the Electro-Thermatic t. m.

process has exceeded our most optimistic forecast. The lubricants produced are more closely controlled, and processing temperatures can be held to plus or minus one-half degree Fahrenheit. The production results we now have indicate that the capabilities of this process far exceed those obtainable with hot oil contact, gas fired, or steam methods used in the past."

This new installation will substantially add to Southwest's manufacturing facilities, capable of producing one-half million pounds of lubricants daily.

New Brochure Covers Pure's Lubricant Line

The Pure Oil company has published a sixteen-page brochure outlining its complete line of industrial lubricants and a program to streamline industrial lubrication program as well as cut costs.

The brochure gives the characteristics and purposes of the company's more than 60 different kinds of industrial lubricants. These are explained in details under such headings as puroturbine oils, engine oils, cylinder and heavy mineral oils, textile oils, gear lubricants, miscellaneous oils, industrial greases.

According to the brochure, Pure's modern research laboratory has studied industry's needs and has developed a compact line of versatile lubricants each capable of handling a variety of jobs, instead of one specific job—and of doing each job equally well. The result is that today thousands of firms have found they can now handle their entire plant lubrications problems with fewer lubricants, fewer manhours and in many cases do a better lubrication job.

In addition, the booklet tells of Pure's industrial lubrication counseling service which is available to its customers at no extra cost.

Qualified Products List

The Rock Island Arsenal, Department of the Army, has announced the intention to establish a Qualified Products List for Grease, Automotive and Artillery, under Specification MIL-G-10924B. Companies which have a product meeting the requirements of this specification are urged to contact the Commanding Officer, Rock Island Arsenal, Rock Island, Ill., Attn: Laboratory, for an opportunity to have their products tested, since in making future awards, awards will be made only for such products as have been tested and approved for inclusion in the Qualified Products List.

SERVICE AIDS

Send Orders to: National Lubricating Grease Institute, 4638 Nichols Pkwy., Kansas City 12, Mo.

REVISED NLGI GLOSSARY — The second edition (Sept., 1961) of this four-page booklet contains fourteen newly-approved definitions of terms relating to the lubricating grease industry, making a total of more than 60 terms and definitions. Usable by marketing as well as technical people. Fifteen cents per copy (NLGI member price) and twenty-five cents (non-member).

BALL JOINT BOOKLET — "Recommended Practices for Lubricating Passenger Car Ball Joint Front Suspensions." The latest aid in application, created by experts in the field and designed for use in the station. Twelve pages, easy to read, with large illustrations throughout. Twenty-five cents a copy with quantity discounts—company imprint arranged.

WHEEL BEARING MANUAL — "Recommended Practices for Lubricating Automotive Front Wheel Bearings." More than 170,000 copies of this booklet have been distributed throughout the world. Now in its sixth printing. Sixteen pages, with more than 40 illustrations. Twenty-five cents a copy, with quantity discounts — company imprint arranged.

NLGI MOVIE — "Grease, the Magic Film," a 16-mm sound movie in color running about 25 minutes, now released. First print $300, second and subsequent orders $200 each (non-members add $100 to each price bracket).

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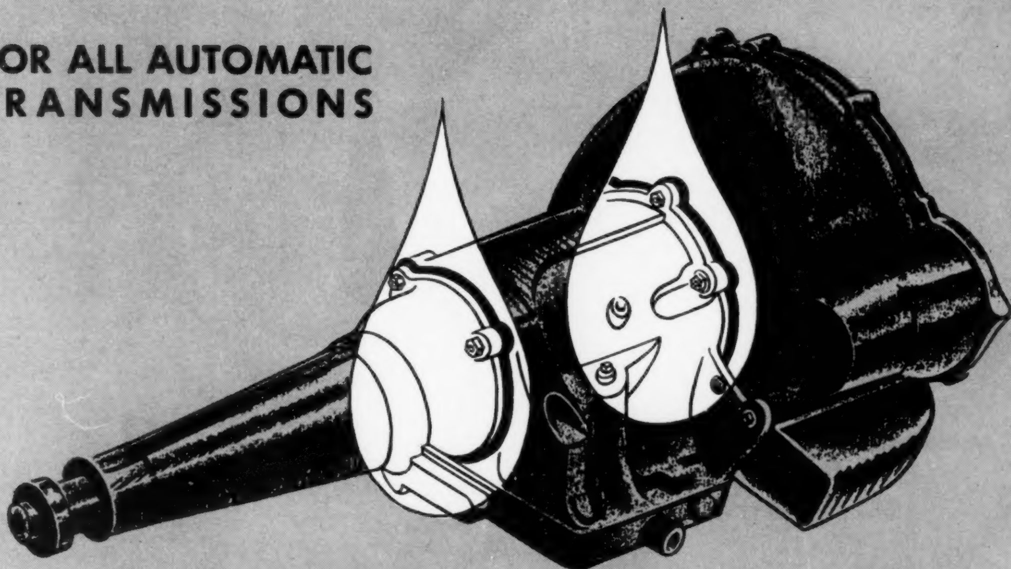

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Oklahoma City, Oklahoma

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DUE TO THE nature of Southwest policy, our interests, goals, and future growth are tied directly to our customers.

THE FOLLOWING is the keystone of Sowesco's marketing policy:

We have no "house" brand that is sold direct to ultimate users.

We sell no products where our name appears on the package unless so requested by the buyer or required by law.

We neither sell nor compound motor oil.

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